The Electrical Industry's Weekly Magazine

February 20, 1956

Electrical World

Price 35 Cents

A McGraw-Hill Publication

SHOPPING CENTER DISTRIBUTION

...PAGE 109

Drop Transformer BIL 2 Steps

...Page 103

5 Current Ratings in 1 Regulator

Vari-Amp Feature Now Available on Distribution Regulators

YOU GET MORE USES FROM A SINGLE REGULATOR now that Allis-Chalmers provides increases in current ratings of as much as 60%. The *Vari-Amp* feature provides convenient stops that limit the range to let you handle more load.

The *Vari-Amp* feature provides considerable flexibility. You can reduce ranges in 1¼% steps from ±10% down to ±5%, increasing current-carrying capacity in steps up to 160%. Range need not be equal in both directions. Set what you need — for example, 6½% raise at 135% current, 10% lower at 100% current.

Best of all, this convenient feature that gives so many more uses for a voltage regulator comes at no extra cost. It gives you more for your regulator dollar because you get a lot more from a single regulator.

Get the complete story by calling your nearby A-C district office. Or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

A-4803

Originators of 5/8% Step Regulation

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Electrical World

Published for 82 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Vol. 145 No. 8 **February 20, 1956**

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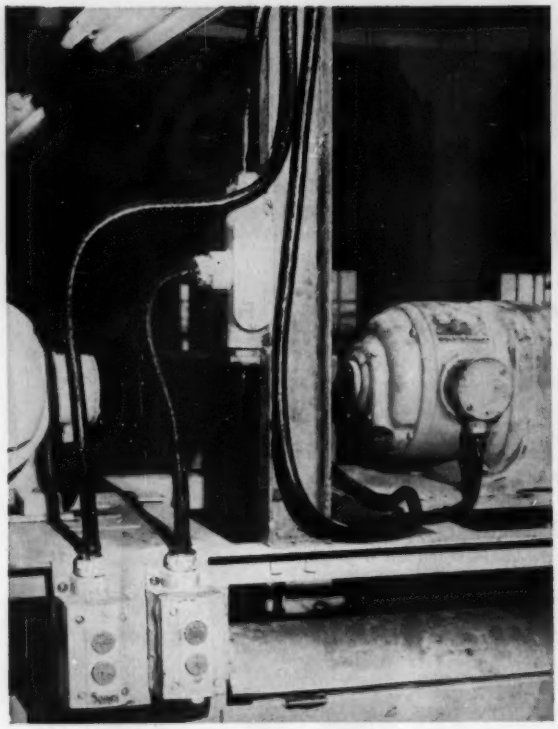
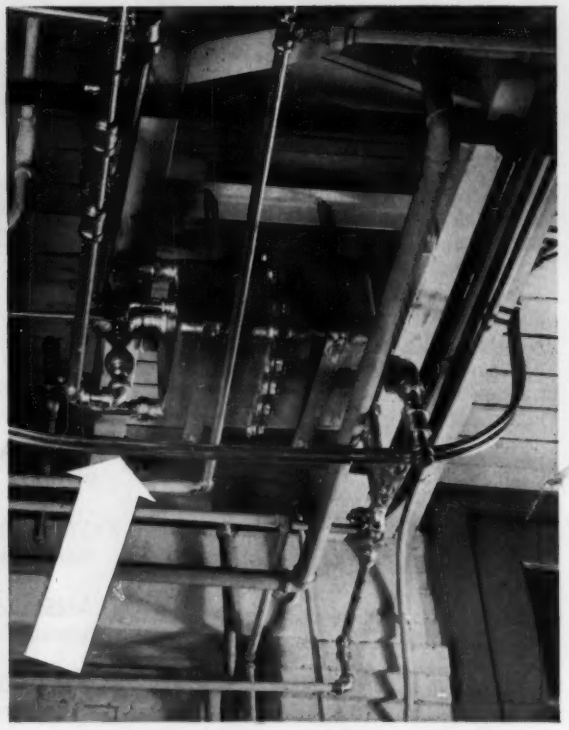


Simple terminations—aluminum-sheathed cables are as simply terminated as conventional rubber-insulated control cables. For leads to motors and control apparatus, an aluminum sheath also provides a neat, space-saving installation. This photo shows optional Okosheath Protective Covering applied over aluminum sheath to combat an extremely corrosive atmosphere in this installation.



Easy installation—aluminum-sheathed cable is inherently rigid, yet see how easily it can be installed around pipes, heat exchangers, and other obstructions. Conduit is eliminated. Regular conduit clamps give all the support necessary for overhead installations. Note that aluminum sheath is seamless, providing a permanent moisture-proof barrier.

new aluminum-sheathed cables eliminate conduit

Many advantages are obtained from the addition of a *seamless* aluminum sheath over standard cable constructions. Virtually any Okonite cable —including rubber, plastic, varnished cambric and paper-insulated constructions—can now be obtained with an Okonite aluminum sheath.

A list of the advantages resulting from this new technique is in the next column. For further information, write to The Okonite Company, Passaic, N. J.

- **no conduit—cuts installation time and costs**
- **eliminates pulling problems and possibility of damage to conductors**
- **high tensile strength and rigidity, yet easily bent with standard tools**
- **impervious barrier to liquids and vapors**
- **mechanically strong**
- **excellent flame resistance**
- **simple terminations**
- **small diameter, light weight**

3502

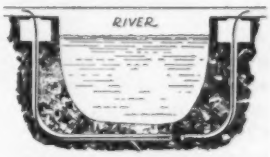
OKONITE insulated cables

10,000 FEET OF CONDUIT RODDED IN 8 HOURS!

Pick-up and Leader fittings meeting

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.



EASY DOES IT!—It's all in a day's work with Electroline Steel Duct-Rodding Equipment rodding 10,000 feet of conduit!

Light in weight, easily handled and stored, low upkeep: these are a few of the advantages utility men know to be true. But even bigger, more important advantages are—

- *Savings in the cost of labor*—for example, where it formerly took two gangs from one to two weeks on a given job, one gang, *in one-half hour*, has completed the same job—using Electroline Duct-Rodding Equipment.
- *Savings in original cost*—you get long life—double that of other types—when you buy Electroline Duct-Rodding Equipment. Add to that this fact: this equipment costs just about half as much for equivalent capacity! *There's true economy.*
- *Savings in Total Investment*—fewer sets are required because of the speed with which a job is completed and the equipment moved to other locations.

Speed up installation, reduce your costs; start now to use Electroline Duct-Rodding Equipment. Available for 3", 3½" or 4" Duct.

We've got a 4-page brochure which describes and illustrates more completely how this equipment can benefit you. We'll gladly send you a copy. Write us.

OTHER *Electroline* PRODUCTS

Electroline Company

4121 South La Salle St., Chicago 9, Ill.
In Canada: POWERLITE DEVICES, LTD., TORONTO

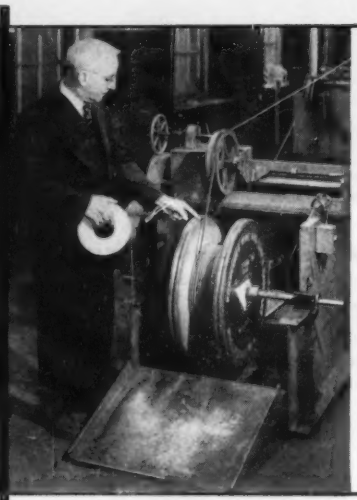
CHASE *the name to remember*

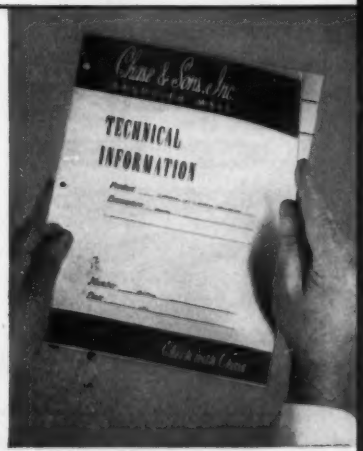
for

LAMINATED INSULATION MATERIALS

◀ Typical of the many Chase products designed for the electrical industry is this generator application where rag paper or kraft paper is combined with DuPont Mylar ® to suit your particular insulation requirements. Chase Slot Insulation comes in sheets, rolls or cuffed.

Complete technical data on Glasterra, or Chasbestos (a combination of asbestos sheet and polyester film) will be sent you upon request. Specifications and samples of all Chase products are available . . . and Chase engineers will gladly help you solve your electrical insulation problems. Chase & Sons, Inc., Randolph, Massachusetts. ▼





▲ Another application where Chase laminated insulation material is used is shown above where double thickness slot insulation is being used in a 15 HP A.C. induction motor. All Chase products are manufactured to meet the highest specifications . . . of the best materials available.

▲ Diversification of Chase product line is further indicated by this illustration showing a development engineer at Kennecott Wire & Cable Co. examining magnet wire insulated with Chase Glasterra Tape. Glasterra is a combination of asbestos sheet, glass yarn or fabric and silicone varnish.

CHASE

ELECTRICAL INSULATING TAPES AND MATERIALS

VALUES TO LOOK FOR IN 2-WAY RADIO...

Look for the Red Head

NEW, CLEAR TALKING, MOBILE MICROPHONE OFFERED YOU FOR RCA 2-WAY RADIO

- **Improved Fidelity.** Better voice quality than ever before.
- **Easy to grasp and hold.** Designed to fit the hand . . . left or right, small or large, bare or gloved. Slip-proof grip.
- **Easy to use.** Positive-action bar switch is of ample length, sturdy and convenient.
- **Easy to hang.** Clips easily into metal hanger, as standard equipment. Rubber cup holder also available, if desired.
- **Easy to service.** Case design assures easy access, simplifies servicing.
- **Distinctive appearance.** Plexiglas mouthpiece, rimmed with aluminum.
- **Built to last.** High-impact Bakelite, guaranteed against breakage for 5 years. Switch, with self-wiping contacts, stands up in all kinds of weather.

Your communications system is only as efficient, in saving time and earning profits, as its components. Look for these marks of quality found in RCA 2-Way Radio: Superior crystals and tubes for clearer talking, longer operation . . . heavy-gauge steel case for rugged service . . . advanced engineering for greatest satisfaction . . . color-coded tuning for simplest maintenance.

"Mark of Quality"

RCA

DISPATCHER — 2-WAY RADIO — TO DRIVER

RCA

RADIO CORPORATION of AMERICA

COMMUNICATIONS PRODUCTS
CAMDEN, N.J.

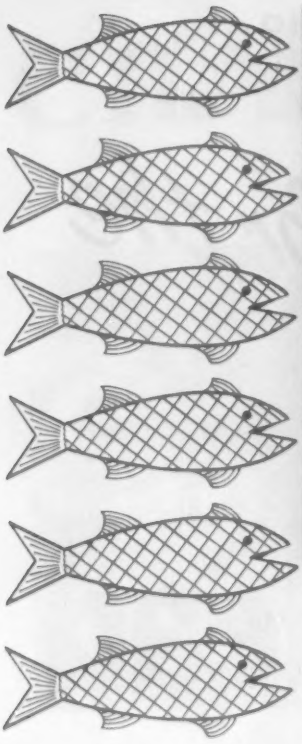
Radio Corporation of America,
Communications Products, Dept. BC-45, Building 15-1, Camden, N. J.
In Canada: RCA VICTOR Company Ltd., Montreal

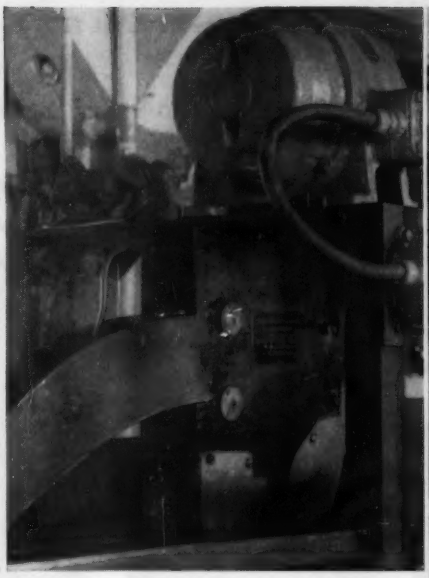
☐ Please send me complete information on the use of 2-Way Radio in . . . .

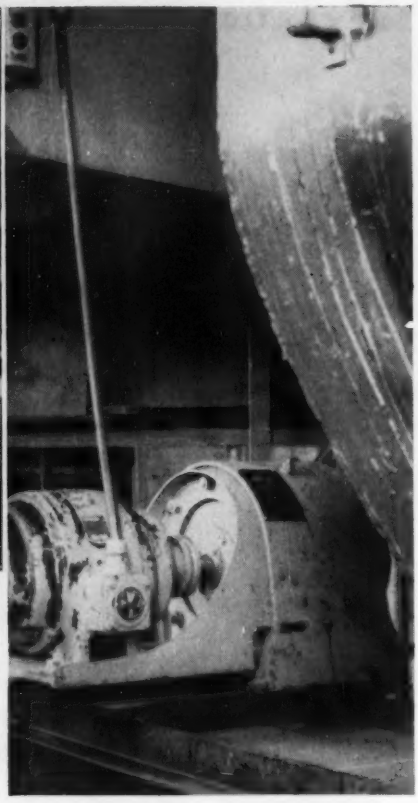
. . . . . .

☐ Have RCA Communications Specialist make a free RADIO SURVEY of my business.

Name . . . . . Title . . . . .
Company . . . . . .
Address . . . . . .
City . . . . . Zone . . . . . State . . . . .







Motors on automatic fish processing line at a Washington cannery, showing flexible leads of tough, water- and oil-resisting TIREX SO Cords that work in a shower of fish cleanings and steam.

TIREX CORDS solve problem of keeping motors running in fish cannery...

Automatic fish processing machines at a Washington cannery take fresh fish at one end of a long table, remove entrails, fins, tails, heads and scales, and deposit meat ready for canning at the other end.

The machines are driven by small motors that work in water and gurry, and that have to be hosed down with live steam.

Water kept getting into the motors and causing them to fail.

The cannery's chief electrician covered the motor cables with three different types of flexible conduits.

None of them kept the motors dry.

He solved his problem this way:

He used TIREX SO Cords with watertight fittings for the motor leads.

Now no water gets into the motors.

TIREX again proved its ability to stand up and "take it", even under constant attack from water, heat and oil.

Have you a problem TIREX might solve? If you have, write to the address below.

Simplex-TIREX SO Cords

SIMPLEX WIRE & CABLE CO.
79 Sidney Street, Cambridge 39, Massachusetts

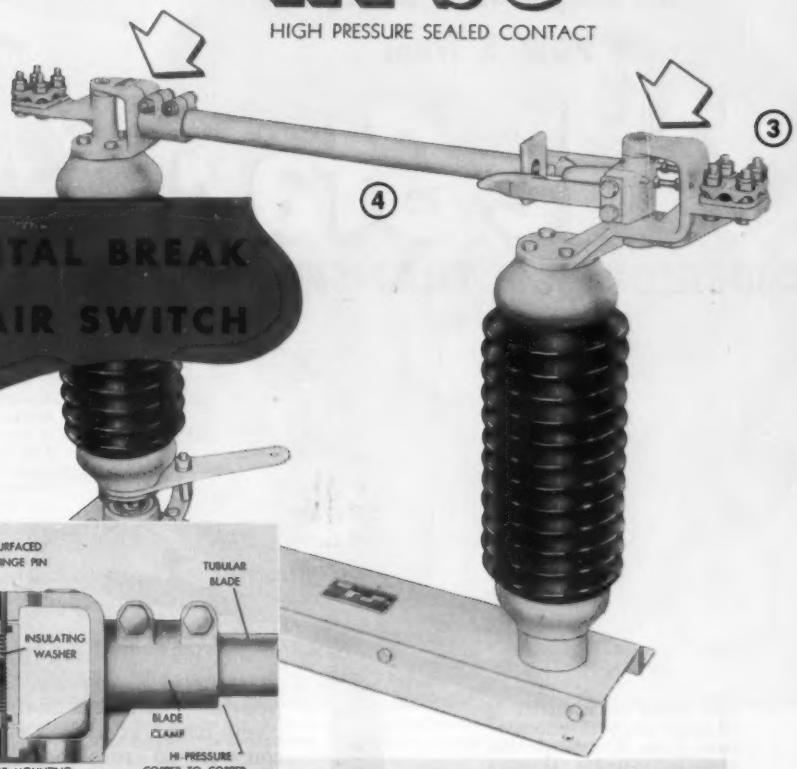
Look for the HPSC

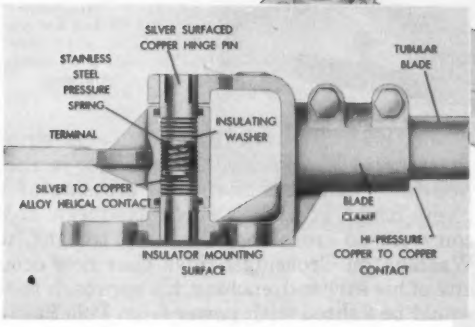
HIGH PRESSURE SEALED CONTACT

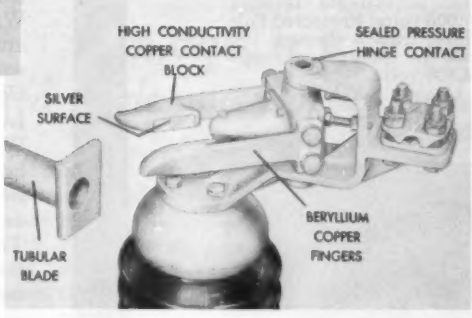
found only on

R&IE

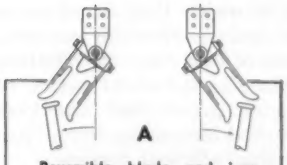
HORIZONTAL BREAK Type A6 AIR SWITCH



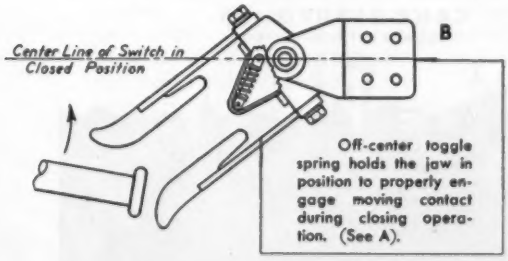




1 **SEALED PRESSURE HINGE CONTACT**—**Identical in construction to that used on highly successful vertical break TTR49 Switch.**



Reversible blade and jaw permit clockwise or counter-clockwise operation.



Off-center toggle spring holds the jaw in position to properly engage moving contact during closing operation. (See A).

2 **HI-PRESSURE JAW CONTACT**—**Hi-Pressure, Hi-Thermal capacity, silver to copper wiping contact. Identical to that on vertical break Type TTR49.**

3 **TERMINALS**—**Both at same elevation from base. Clamp type suitable for R&IE Type UC universal, Type TL, or any NEMA standard 400, 600 or 1200 ampere clamping.**

4 **BLADE**—**Extra heavy, tubular hard-drawn copper with brazed-on contact block.**

5 **FULLY TESTED**—**Electrically and mechanically for 1. Dialectric, 2. Thermal, 3. Momentary and 4. Ice Breaking (According to NEMA recommended procedure)**

●

R&IE SWITCHING EQUIPMENT

DIVISION OF I-T-E CIRCUIT BREAKER CO.

GREENSBURG, PA.

STRUCTURES—steel or aluminum ● TESTING DEVICES ● KIRK KEY INTERLOCK SYSTEMS ● ISOLATED PHASE BUS STRUCTURES ● INTERRUPTER SWITCHES

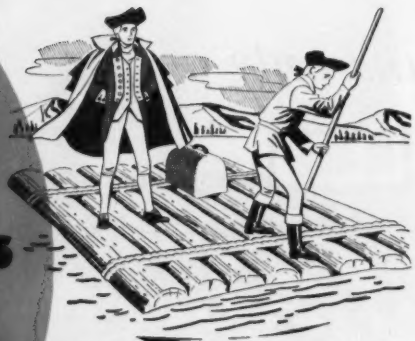
INDOOR BUS SUPPORTS and BUS FABRICATION ● OUTDOOR BUS SUPPORTS and AIR SWITCHES ● SUBSTATION

If George Washington Crossed the Allegheny River Tonight . . .

His way would be lighted with POWER from

Pole Star

DISTRIBUTION TRANSFORMERS

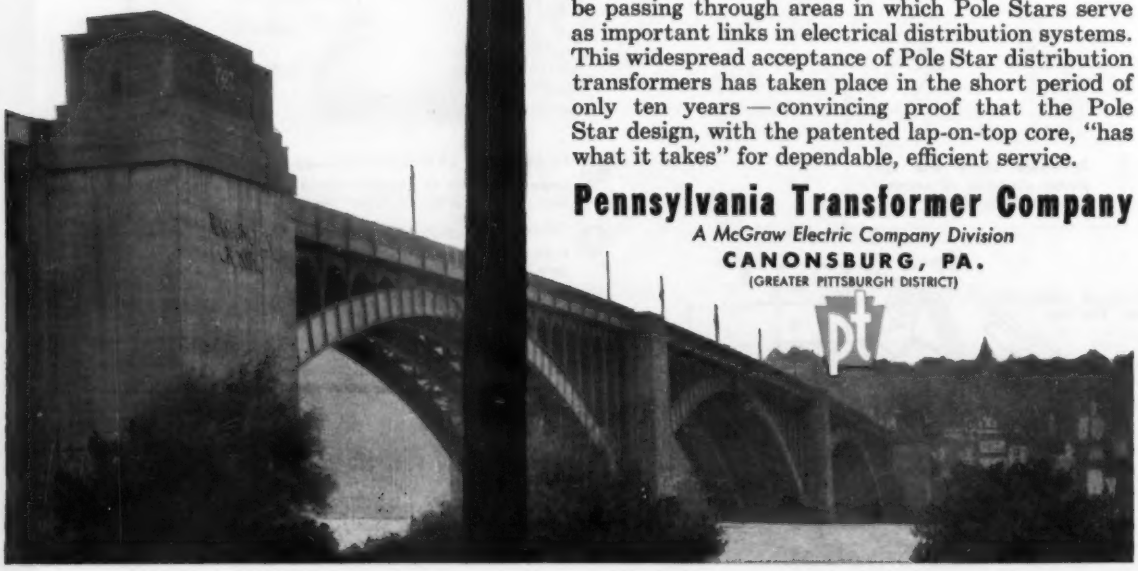


In December of 1753, Major Washington and his guide, Christopher Gist, were returning to Virginia after having delivered a message to a fort near present-day Erie, Pa. The two men built a log raft on which they attempted to cross the Allegheny River at a point several miles above where that river joins the Monongahela River to form the mighty Ohio. Their raft upset in midstream, but the two men were able to swim to an island, where they spent the night before making a second, successful attempt to cross the stream.

Pole Stars are available in all single phase distribution sizes from 3 through 500 kva, in voltages through 67,000 volts; Protected Pole Stars, from 3 through 100 kva, in voltages through 14,400 volts.

It has been over two hundred years since George Washington — who was then a major in the Virginia Militia — made his near-fatal crossing of the Allegheny River, at what is now Pittsburgh. If Washington were to cross the Allegheny tonight, using the Washington Crossing Bridge that now occupies the site of his earlier drenching, his approach to that span would be lighted with power from Pole Star distribution transformers.

In fact, just about anywhere in the country that Washington might travel — and in this day and age he probably would explore most of it — he would be passing through areas in which Pole Stars serve as important links in electrical distribution systems. This widespread acceptance of Pole Star distribution transformers has taken place in the short period of only ten years — convincing proof that the Pole Star design, with the patented lap-on-top core, "has what it takes" for dependable, efficient service.



Pennsylvania Transformer Company

A McGraw Electric Company Division

CANONSBURG, PA.

(GREATER PITTSBURGH DISTRICT)

Hydroelectric plant of The Washington Water Power Company at Cabinet Gorge, Washington.
This is the highest head installation in the United States using both fixed blade and Kaplan turbines.

282,000 H.P.

produced at lowest cost by fixed blade and Kaplan turbine team

In operation at the Cabinet Gorge hydroelectric plant of The Washington Water Power Company are three Baldwin fixed blade propeller turbines and one Baldwin Kaplan turbine.

These unusual 6-blade Baldwin units were designed for a normal head of 90 feet with a rating of 70,500 H.P. each at 120 R.P.M. Under certain conditions, the head reaches 105 feet, which increases total output to over 325,000 H.P. In terms of horsepower capacity, the fixed blade turbines are the largest ever installed in the United States. Each type of turbine has its own inherent advantages, and by using them in proper combination, the Cabinet Gorge plant is able to operate at maximum efficiency on a minimum investment.

All over the world, hydroelectric plants are reaping the benefits of Baldwin's 130 years' experience in designing and building hydraulic power equipment. Since we build all four basic types (Impulse, Kaplan, Francis and Propeller), our engineers can make unbiased recommendations on the type best suited to *your* flow and head requirements. On your next project, call us in early. Write BLH Corporation, Philadelphia 42, Pennsylvania, or Pelton Division, 2929 Nineteenth St., San Francisco 10, California.

Inspecting the hub mechanism of the Kaplan turbine.

EDDYSTONE DIVISION
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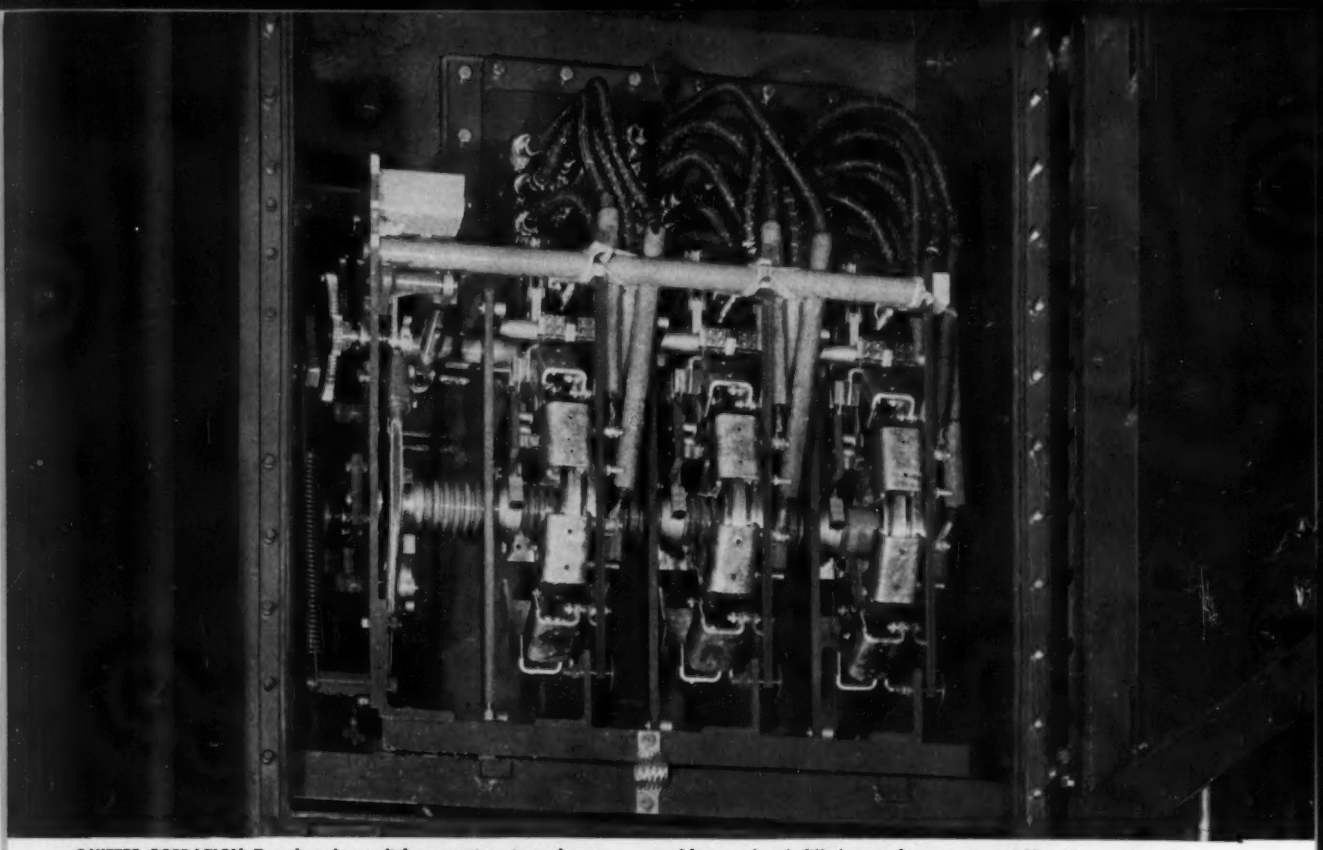
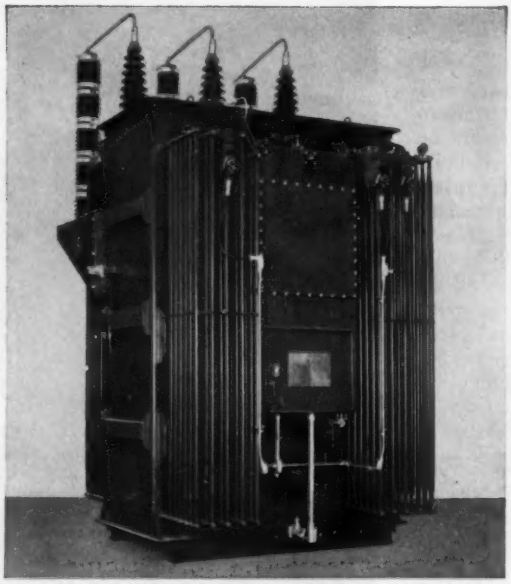
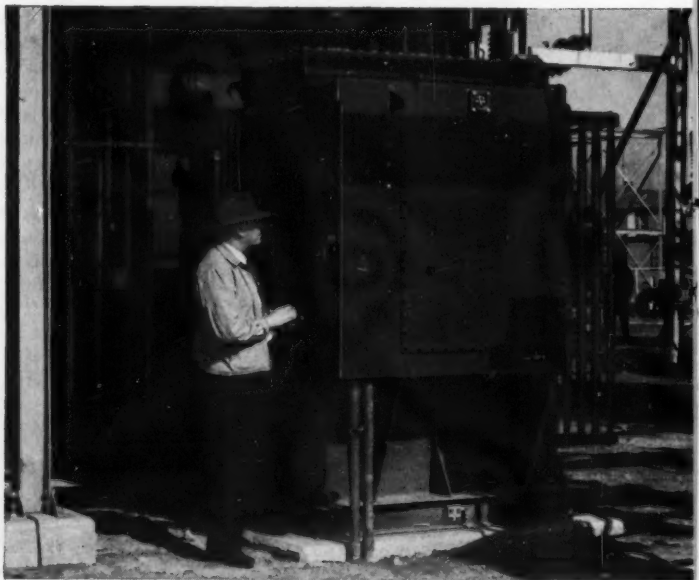


QUIETER OPERATION. Tap-changing switch compartment now houses motor and drive assembly completely immersed in oil to muffle noise and provide permanent lubrication. Formerly, motor plus assembly was in air-filled control compartment. Mounting under oil, and redesigning of geneva gear for smooth driving-pin entry—without impact—has cut peak noise level about 20 db.

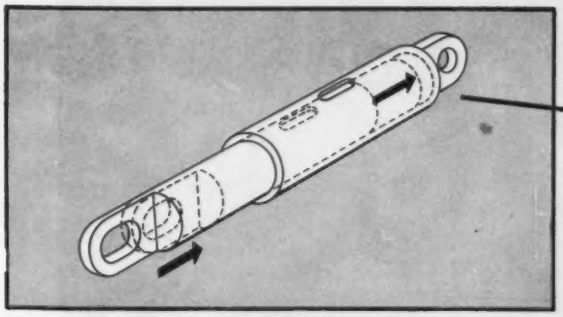
Maintenance reduced 50% by new



RM MEDIUM TRANSFORMERS employ the new LRT-68 load-tap-changing switch in LTC models.

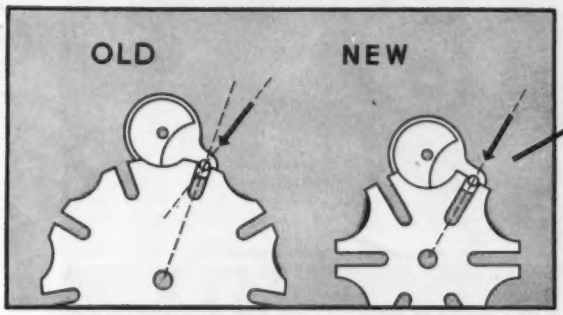


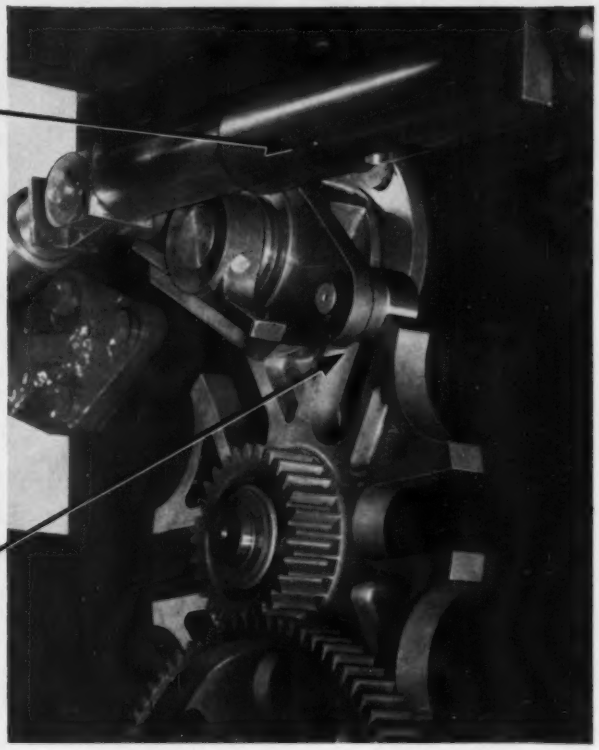
STEP REGULATORS up to 1000 kva will now have the added advantages of the new LRT-68 load-tap-changing switch.



HYDRAULIC DASHPOT

NEW GENEVA GEAR





REDUCED MAINTENANCE. LRT-68 incorporates new hydraulic dashpots and redesigned geneva gear. The two dashpots provide (1) optimum contact separation speed, and (2) reduced engagement velocity, for minimum contact erosion and less secondary arcing.

Geneva gear driving-pin now enters gear slot smoothly, parallel to the side of the slot. Previous design entered at 19° angle. Gentle acceleration and deceleration reduces jarring and mechanical wear. This, plus thicker contact tips, results in 100% increase in tip life.

General Electric load tap changer

Peak operating noise cut 20 db with LRT-68 switch now used on RM transformers and three-phase step regulators

DOUBLED CONTACT LIFE of General Electric's new LRT-68 load-tap-changing switch means routine inspection and maintenance can be *cut in half* on G-E LTC Medium Transformers, and on three-phase step voltage regulators up to 1000 kva.

These savings have been made possible by: (1) reducing the amount of contact wear per operation, through redesigning the geneva gear (providing smoother operation) and adding hydraulic dashpots (for optimum separation and engagement speeds) and (2) using heavier, thicker contact tips, from which more material can wear before replacement is necessary.

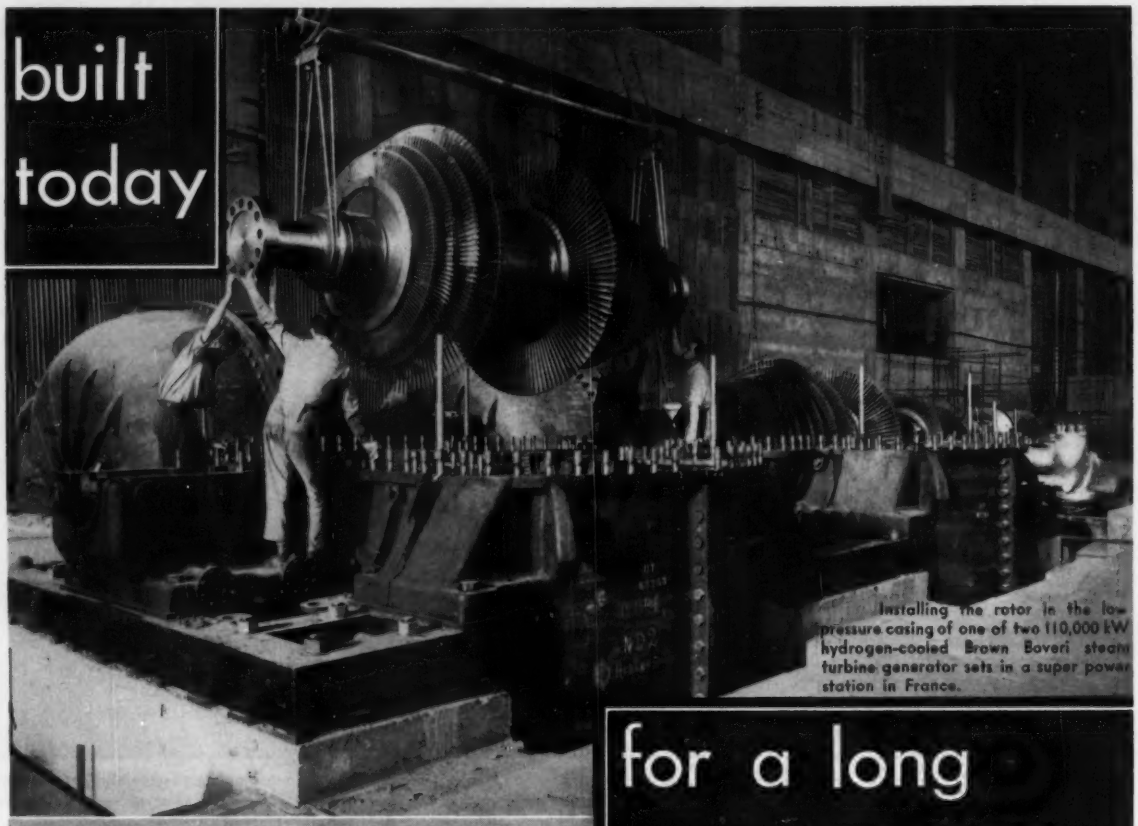
REDUCED OPERATING NOISE results from a complete redesign of G.E.'s load-tap-changer. This means increased consumer good will and less investment in sound-absorbing walls and barriers, when LTC equipment is installed in residential areas.

For full information on this new load-tap-changing mechanism and the medium transformers and three-phase, step voltage regulators on which it will be used, contact your nearest General Electric Apparatus Sales Office, or write Section 416-4, General Electric Company, Schenectady 5, New York.

Progress Is Our Most Important Product

GENERAL ELECTRIC

built today



Installing the rotor in the low-pressure casing of one of two 110,000 kW hydrogen-cooled Brown Boveri steam turbine generator sets in a super power station in France.

for a long tomorrow

BROWN BOVERI

GENERATION after generation of dependable power generation is engineered into the design of each Brown Boveri turbo-generator. Yet, it's more than a matter of merely an advanced design. It's traditional skill of craftsmen, acquired through long years of apprenticeships in their crafts... fabricating the best of materials... taking the time required for precision operations.

It is these men who build into each turbo-generator world-famous Brown Boveri quality ... the long life ... the high efficiency ... and its low maintenance and low initial cost.

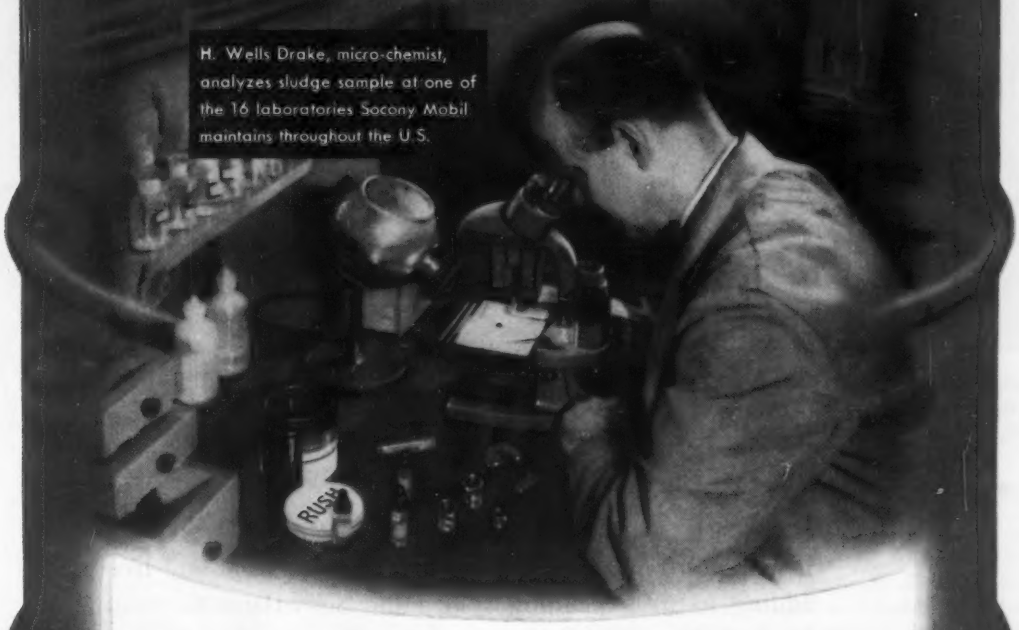
You *can expect* more... and you *do get* far more... from a Brown Boveri Turbo-Generator. Write for the facts today!

BROWN BOVERI CORPORATION

19 RECTOR STREET • NEW YORK 6, N. Y.

Atlanta, Ga. • Birmingham, Ala. • Boston, Mass. • Buffalo, N. Y. • Butte, Mont. • Chicago, Ill. • Cleveland, O. • Denver, Colo. • Detroit, Mich. • Hamilton, O. • High Point, N. C. • Houston, Tex. • Jacksonville, Fla. • Kansas City, Mo. • Knoxville, Tenn. • Lewiston, Me. • Miami, Fla. • Minneapolis, Minn. • New Orleans, La. • New York, N. Y. • Pasadena, Calif. • Portland, Ore. • Roanoke, Va. • San Francisco, Calif. • Seattle, Wash. • Syracuse, N. Y. • Tucson, Ariz.

There's more in this barrel for you...



H. Wells Drake, micro-chemist, analyzes sludge sample at one of the 16 laboratories Socony Mobil maintains throughout the U.S.

MORE ANALYTICAL SERVICE

to help you improve production and cut costs!

Socony Mobil offers far more analytical service than any other oil company . . . more laboratories to provide you with detailed performance data on the Mobil products you use in your plant. This service also includes recommendations which can materially help improve your production and lower unit costs.

Socony Mobil products are also backed by *more* field engineers serving industry . . . *more* continuous research to assure continually improved products . . . *more* on-the-job training of your personnel in correct product application . . . *more* approvals from machine builders . . . *more* practical experience—90 years.

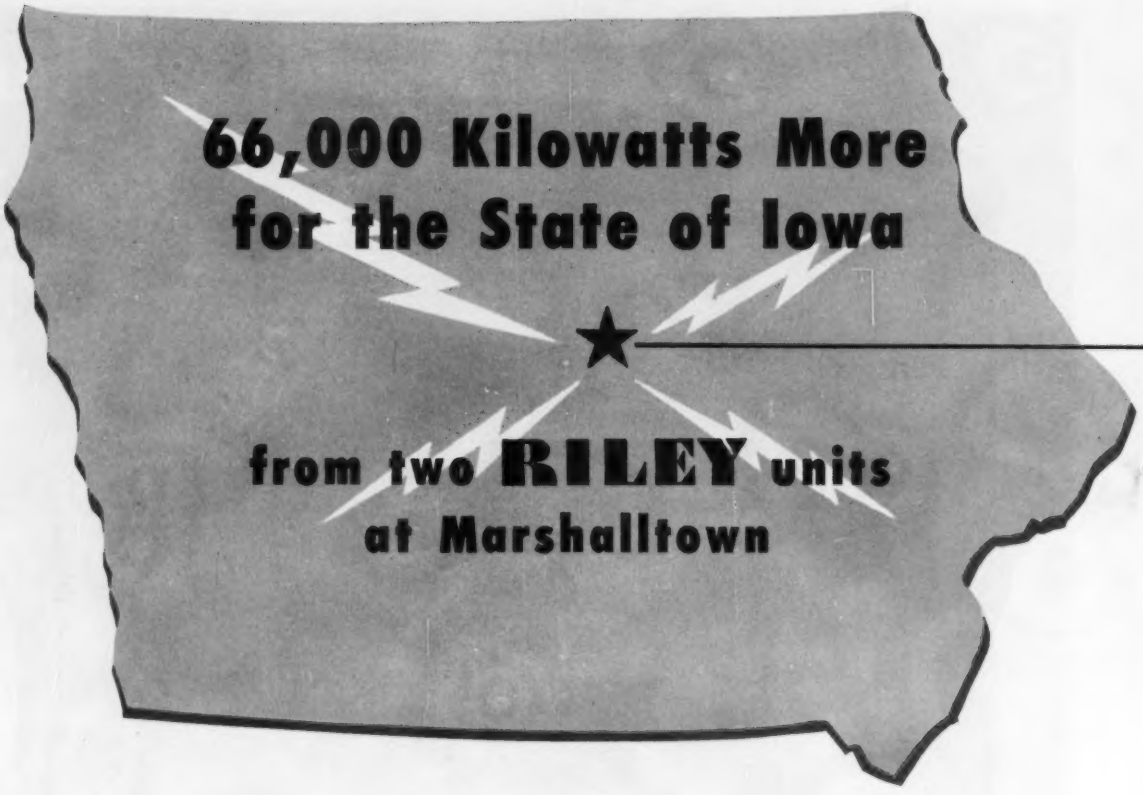
Always specify Socony Mobil. There's *more* in every barrel for you!

SPECIFY **SOCONY MOBIL**

FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM COMPANY
GENERAL PETROLEUM CORPORATION

LUBRICANTS • FUELS • CUTTING FLUIDS • WAXES • SOLVENTS • PLASTICIZERS • PETROCHEMICALS

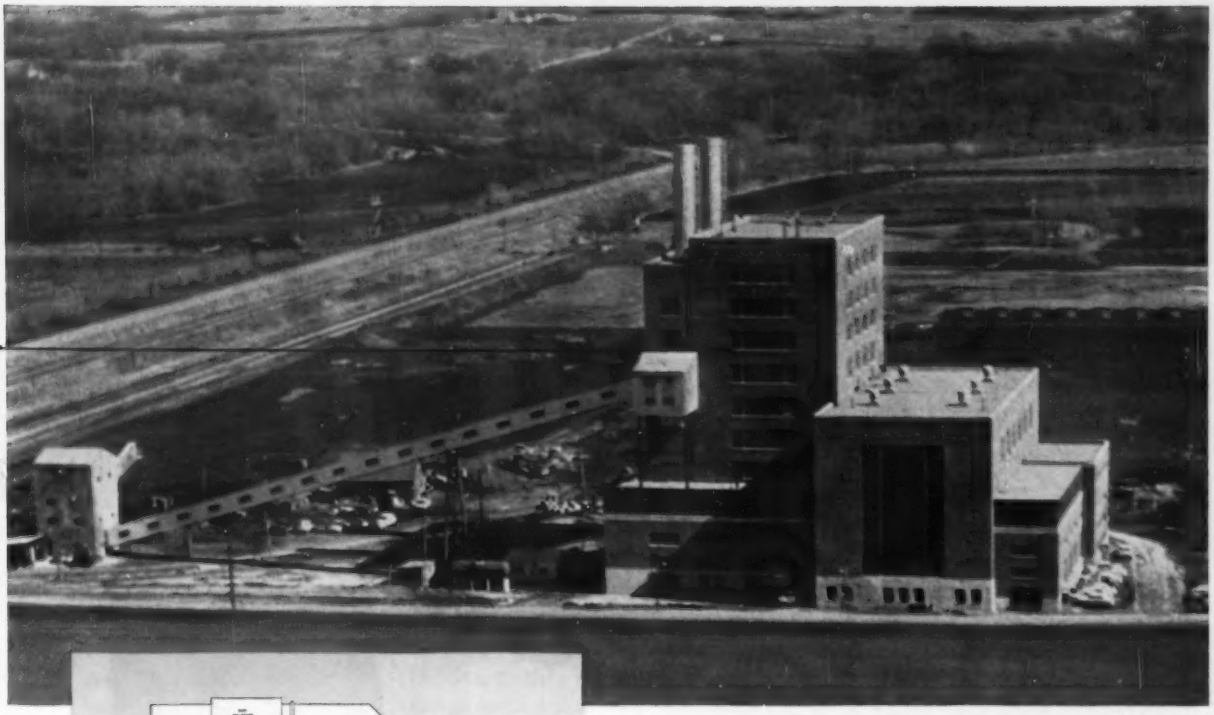


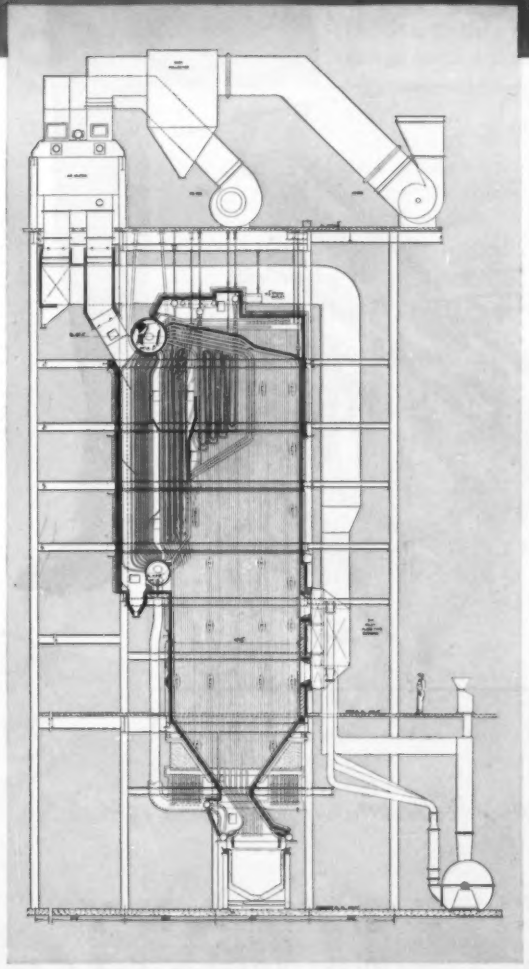
Iowa Electric Light & Power Company is helping to make Iowa a brighter place to work and live by adding to its expanding system the Sutherland Generating Station with its 66,000 Kw. capability. Two new highly efficient Riley Steam Generating Units provide the steam and are the latest Riley units to go on the line in Iowa. They are the second and third Riley units installed in the Iowa Electric Light & Power Company system.

The first Riley unit was placed in operation in September 1953 at the Boone Generating Station of the Iowa Electric Light & Power Co. This was a complete Riley unit having a capacity of 275,000#/hr at a pressure of 675# and a steam temperature of 835°.

A survey of your plant by a consulting engineer could show ways of making surprising savings in your power costs.

RILEY DESIGNS, MANUFACTURES AND INSTALLS COMPLETE STEAM GENERATING UNITS AND FUEL BURNING EQUIPMENT FOR PUBLIC UTILITY AND INDUSTRIAL POWER AND HEATING PLANTS





Sutherland Generating Station at Marshalltown produces 66,000 Kw. from two 300,000#/hr Riley Steam Generating Units with steam at 875 psig and 915 F.

Furnaces Designed for Burning Low Grade Coals and Natural Gas.

Adequate furnace design insures clean furnace and boiler surfaces when burning Iowa coals with low fusion temperature ash. Flexibility of design permits rapid change of fuel as desired. Riley heat exchanger type steam temperature control maintains design steam temperature over full load range with both coal and gas.

Complete Riley Units under One Contract.

Each unit is equipped with six Riley Burners for firing natural gas and coal, and three #550 Riley Pulverizers . . . a typical instance in which the advantages of Riley fuel burning equipment are ideally suited to the fuels to be burned. Tungsten carbide used in Riley mills resists the extreme erosion effects of abrasive coals to assure continuity of operation and low maintenance.

RILEY
Stoker Corporation
WORCESTER, MASSACHUSETTS

Sales Offices: Worcester, New York, Philadelphia, Buffalo, Washington, Pittsburgh, Cleveland, Detroit, Chicago, Cincinnati, Charlotte, New Orleans, Atlanta, St. Louis, Kansas City, St. Paul, Houston, Denver, Salt Lake City, Los Angeles, San Francisco, Portland, Seattle.

how much protection is a hook stick?

Have you ever seen a distribution cutout blow? More important, have you ever closed a cutout against a heavy fault? If so, then you know the violence of the blast and how dangerous it can be to the operator . . . dangers that are multiplied many times when a cutout fails—possibly explodes.

No wonder a lineman wants to stay as far away as possible—close it in with a ten-foot pole! Perhaps a hook stick was protection enough when faults were lower, but today a hook stick is usually inadequate. Safety must be built into the cutout itself. It *can* be done . . . it IS being done. S&C Positect Cutouts have these basic safety features:

1. **INTERRUPTING CAPACITY** high enough to meet every fault condition on a typical feeder—yet available at a cost in keeping with "normal duty" budgets. Thus it is not necessary to take "calculated risks."
2. **DESIGNED AND TESTED** for closing against a fault—"make" as well as "break."
3. **INTERRUPTING RATINGS** apply to closing in on a fault—not just clearing it.
4. **BLAST DIRECTED AWAY** from the operator, so he is out of reach of the arc, flame, and "shrapnel" in case he closes in on a fault.
5. **KICKBACK PREVENTED** by high inertia of the fuse tube as it is driven home, directly opposing the recoil forces.
6. **BLAST MINIMIZED** by arc shortening and freer venting.

Detailed information about the S&C Positect is contained in Catalog Sec. 520 . . . write for a copy.

It is SAFE to close the Positect by hand

Specialists in High-Voltage Circuit Interruption since 1910

S&C ELECTRIC COMPANY

4435 RAVENSWOOD AVENUE • CHICAGO 40, ILLINOIS, U. S. A.

In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ontario

POWER FUSES • DISTRIBUTION CUTOUTS AND FUSE LINKS • LOAD INTERRUPTERS • METALCLAD SWITCHGEAR

ELECTRICAL BUSINESS OUTLOOK

Electrical World
FEBRUARY 20, 1956

Average residential use 3,000 kwhr this year? That's our current prediction of what can be done, but it will mean an increase of 245 kwhr compared to the 206 kwhr increase chalked up by the industry for 1955 over '54.

There's firm basis for this optimism. Appliance sales hit a record $7.9 billion last year for over 85 million units. Largest share of these came in last quarter when total personal expenditures were running at a rate of $257.5 billion a year vs $250.5 in second quarter and $245.8 in first quarter. Appliances bought in last quarter will be on line all year to shove up average use. Another key factor is predicted increase of $13 billion in consumer disposable income this year which would mean gain of $12 billion in personal expenditures.

Lower car output could also be on plus side. If auto sales drift downward with output, situation would leave more consumer dollars for appliance purchases. Last year the car dealer got 58¢ of every dollar spent for durable goods, the electrical appliance dealer only 15¢.

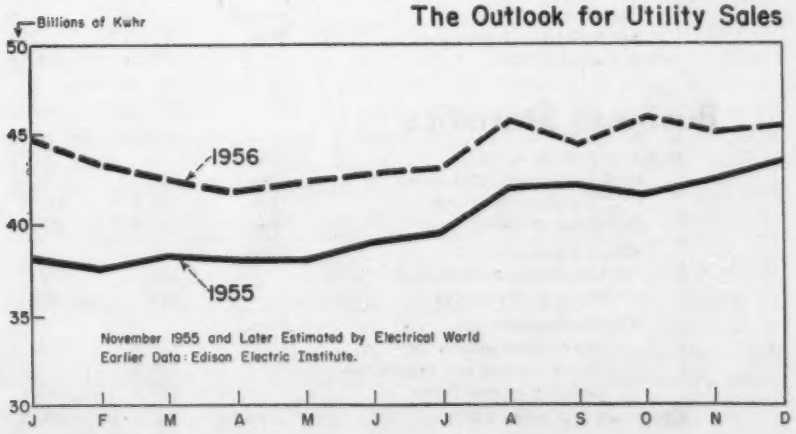
Fewer home starts mean fewer new customers and less dilution. Business and government economists now expect about 1.2 million residential starts this year compared with 1.3 million last year. This will mean fewer new customers but might push up average use as new home owners usually space out appliance buying after home down payment.

Big load growth area is sure to be air conditioning. One manufacturer sees outlook for sales of 9 million room cooler units over next five years. That's the forecast of J. A. Rishel, Jr, general sales manager of Amana Refrigeration, Inc, who also believes sales of central air conditioning systems will hit 175,000 this year—up 50% over 1955.

• • •

Commercial and industrial building market tight. Value of construction to be put in place this year will be 5% above last year according to the McGraw-Hill Department of Economics. Big increase will be in commercial and industrial with residential building dropping. For electric utilities this means new customers, but it also means a tight market in which to construct the office and service buildings planned for this year.

The Outlook for Utility Sales



STATISTICS

Power Statistics . . .

			Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	million kw	Nov.	113.55	112.13	101.11	12.3
Peak—Class I Systems	million kw	Nov.	96.4	90.6	82.0	17.6
Estimated Dec. '55 Peak	million kw	Nov.	97.44	96.72	96.07	1.4
Estimated Dec. '56 Peak	million kw	Nov.	104.55	104.34	102.71	1.8
Production—billion kwhr		Nov.	47.76	47.37	40.21	18.8
Hydro			9.21	8.77	8.11	13.6
Fuel			38.54	38.60	32.10	20.1
Sales—billion kwhr		Nov.	43.07	43.16	36.29	18.3
Residential			10.71	10.33	9.72	10.2
Commercial			6.61	6.87	6.08	8.7
Industrial			23.37	23.45	18.26	28.0
Other			2.38	2.51	2.23	6.7
Fuel Consumption		Nov.				
Coal—million tons			13.29	12.70	10.70	24.2
Oil—million barrels			7.10	6.04	5.82	22.0
Gas—billion cu ft			82.26	104.75	88.40	−6.9
Net Income Class A & B Co's—$ million		Nov.	104.29	95.67	95.12	9.6
Residential Customers—millions		12 mos.	44.30	44.21	43.04	2.9
Revenue per kwhr		ended	2.65¢	2.65¢	2.70¢	−1.9
Avg kwhr per customer		Nov. 30	2,728	2,715	2,529	7.9
Avg annual bill			$72.29	$71.95	$68.28	5.9

Business Statistics . . .

Indexes: 1947-49 = 100					
FRB Industrial Production	Dec.	141	146	128	10.2
ENR Construction Cost	Jan.	141.8	141.1	135.1	5.0
BLS Cost-of-living	Dec.	114.7	115.0	114.3	0.3
NEMA Sales	Dec.				
Insulation materials		160	155	138	15.9
Electric appliances		101	88	74	36.5
Wholesale prices	Dec.				
Motors and generators		127.2	127	121.8	4.4
Transformers and regulators		129.2	129.2	128.1	0.9
Switchgear and fuses		145.9	145.9	135.3	7.8
GNP—annual rate—$ billion	3rd Qtr.	392.0	384.8	358.8	9.3

Your Business

Poetry, said Cleveland Electric Illuminating Executive Vice Pres Ralph Besse in a recent article (EW, Oct. 17, p 112), has reached the vanishing point with businessmen.

This may not be true—at least among engineers. A distribution session of the recent AIEE winter general meeting inspired H. M. Jalonack of GE's Distribution Transformer Department to forget higher voltages long enough to pen the following:

"A bunch of bees deciding to swarm
To find a home cozy and warm,
With automatic heat and a dormer,
Picked a self-protected transformer.

Now this meant trouble of a sort;
The bees in coming caused a short
Costing Long Island lots of money,
Proving there's more to a bee than honey.

Though honey may be sweet to sip,
It made the doggone breakers trip."

Could Mr Besse be wrong?

Talk of bees reminds us that summer soon will be here, bringing with it the recurrent search by weekend golfers for some easy way to improve their games.

Professional golfers say there are four ways to improve your game: 1. Hire a good teacher, 2. practice, 3. practice, and 4. practice.

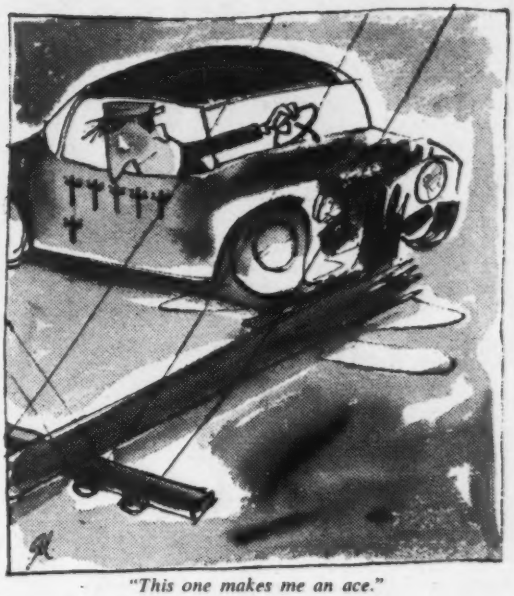
The Spalding sports goods people are trying to add a fifth way: Make the clubs so good you'll knife the fairway every time. At least, they say, you should take several strokes off your game with their new Synchro-Dyned matched clubs.

Synchro-Dyned clubs, according to Spalding, are the result of the application of science and a closely guarded secret formula to club making. The end product is a set of clubs with a center of gravity so located as to produce identical feel and consistently uniform playing characteristics in the entire set. In other clubs, says Spalding, the centers of gravity follow a random pattern.

Some thoughts on life and character by Benjamin Franklin:

"He that is secure is not safe."

"The second vice is lying; the first is running into debt."



"This one makes me an ace."

Your Health

REX H. WILSON, MD, Medical Director, B. F. Goodrich Co

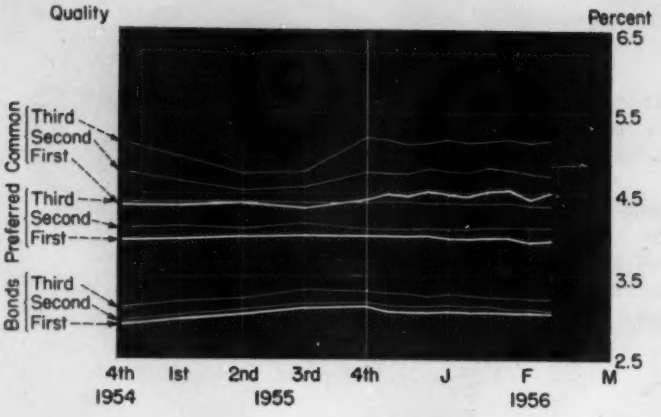
A truck driver was involved in a serious accident. His driving judgement had been poor. On examination his vision was blurred, and he appeared to be a "nervous wreck."

He was a benzedrine addict. He had been taking these pills for a long time to keep himself awake during working hours, and finally the toxic effects had caught up with him.

The amphetamines (benzedrine and dexedrine) are prescribed to depress the appetite for weight reduction. They also elevate the mood by stimulating the brain. They are said to bring relief from emotional upsets, discouragement, fear and anxiety, aid in clear thinking and talking, provide a stimulus for work, and will cast off feelings of weakness and exhaustion. All these benefits sound wonderful, but there is a catch. Some people like the effects so well that they want more and more of the same. Eventually, the effects become unpleasant. The addiction causes over stimulation of the nervous system, and the next step is to take a sedative like phenobarbital to try and calm down. Soon the addict is on a vicious merry-go-round, taking one pill for a lift and another to quiet down. A "crack-up" is inevitable.

Stimulants should only be taken under direct supervision of a physician. Health cannot be bought at the corner drug store. There is no substitute for ample rest, adequate diet, and a serene disposition. Why settle for 50 years when you could have 100?

Today's Utility Yields (%)



	BONDS			PREFERRED STOCKS			COMMON STOCKS		
QUALITY	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
Feb. 9	3.04	3.08	3.20	3.95	4.09	4.38	4.51	4.72	5.17
Feb. 2	3.04	3.09	3.20	3.94	4.09	4.38	4.49	4.75	5.11

Utility Earnings

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Central Maine Power	12	Dec.*	$6,798,141	$5,950,453	$1.79	$1.56
Duquesne Light	12	Dec.*	17,879,908	15,880,695	2.34(a)	2.26(a)
Gulf States Utilities	12	Dec.*	10,639,980	9,483,968	2.16	1.88
Idaho Power	12	Dec.*	5,027,904	4,818,907	1.87	1.80
Middle South Utilities, consolidated	12	Dec.*	16,824,762	16,193,738	2.21	2.13
Tampa Electric	12	Dec.*	3,410,990	2,977,025	1.37(b)	1.37(b)
Virginia Electric & Power	12	Dec.*	19,052,033	16,786,651	2.54	2.20

Notes—*Subject to year-end audit; (a) Based on 6,600,000 shares in 1955 and 6,150,000 shares in 1954; (b) Based on 2,172,855 shares in 1955 and 1,975,323 shares in 1954.

Utility Financing

COMPANY AND DESCRIPTION	AMOUNT OF OFFERING (000)	OFFERING PRICE	YIELD TO PUBLIC
FEBRUARY 9-15			
BONDS			
Central Power & Light—1st mtg 3¼% due 1986	$10,000	100.959%	3.20%
Dallas Power & Light—1st mtg 3⅛% due 1986	10,000	101.681	3.09
PREFERRED STOCK			
Southern California Edison—1,200,000 sh 4.24% $25 par	$30,000	$25.55	4.15%
SCHEDULE FOR FEBRUARY			
BONDS			BID DATE
Kansas Gas & Electric—1st mtg due 1986	$7,000	.....	Feb. 27
Texas Electric Service—1st mtg due 1986	10,000	.....	Feb. 28
PREFERRED STOCK			
Northern States Power—100,000 sh $100 par cum	$10,000	.....	Feb. 29
COMMON STOCK			
Southern Indiana Gas & Electric—83,030 sh (to be offered commonholders on 1-for-11 basis, record Feb. 21 to expire Mar. 5)	.....	.....	.....
Kansas Gas & Electric—200,000 sh	.....	.....	Feb. 27

FINANCIAL BRIEFS

Kansas City Power & Light Co will pay Mar. 10 a quarterly common stock dividend of 50¢ a share as compared with 45¢ a share in the previous quarter. Company is planning to sell 120,000 shares of preferred stock around mid-April, Pres H. B. Munsell has reported.

Central Illinois Public Service Co will pay Mar. 10 a quarterly common stock dividend of 40¢ a share versus 35¢ previously.

Institutional Investors Mutual Fund, Inc, has purchased 500 shares of common stock of each of these electric companies during the fourth quarter of 1955: Baltimore Gas & Electric Co, Consolidated Edison Co of New York, Gulf States Utilities Co, Southern California Edison Co, and Wisconsin Electric Power Co. In addition the fund added these companies to its common stock portfolio: 220 shares of Kansas City Power & Light Co, 1,000 shares of Northern States Power Co (Minn.), 400 shares of Oklahoma Gas & Electric Co, and 300 shares of Philadelphia Electric Co.

Department of Water and Power of the City of Los Angeles, Calif., will open bids on Feb. 20 for $24 million electric revenue bonds due 1957-81.

Michigan Gas & Electric Co will pay Mar. 31 a quarterly common stock dividend of 50¢ a share as compared with 45¢ in each of the first three quarters and 15¢ plus a 3% stock dividend in December.

Future Financing—Electric companies are planning sales of securities in 1956 as follows: **Bonds** . . . Appalachian Electric Power Co, $25 million in the latter part of the year; California Oregon Power Co, $16 million sometime in April or May; Duquesne Light Co, about $20 million in May; Jersey Central Power & Light Co, $9 million in June; Kentucky Utilities Co, $10 million in April; Narragansett Electric Co, $10 million in March; and Virginia Electric & Power Co, $20 million in bonds in September. **Common Stock** . . . Central Illinois Light Co, 100,000 shares; Delaware Power & Light Co additional common stock, and New England Electric System, 834,976 shares in April.

Announcing . . . . .

A Completely New G-E Recloser

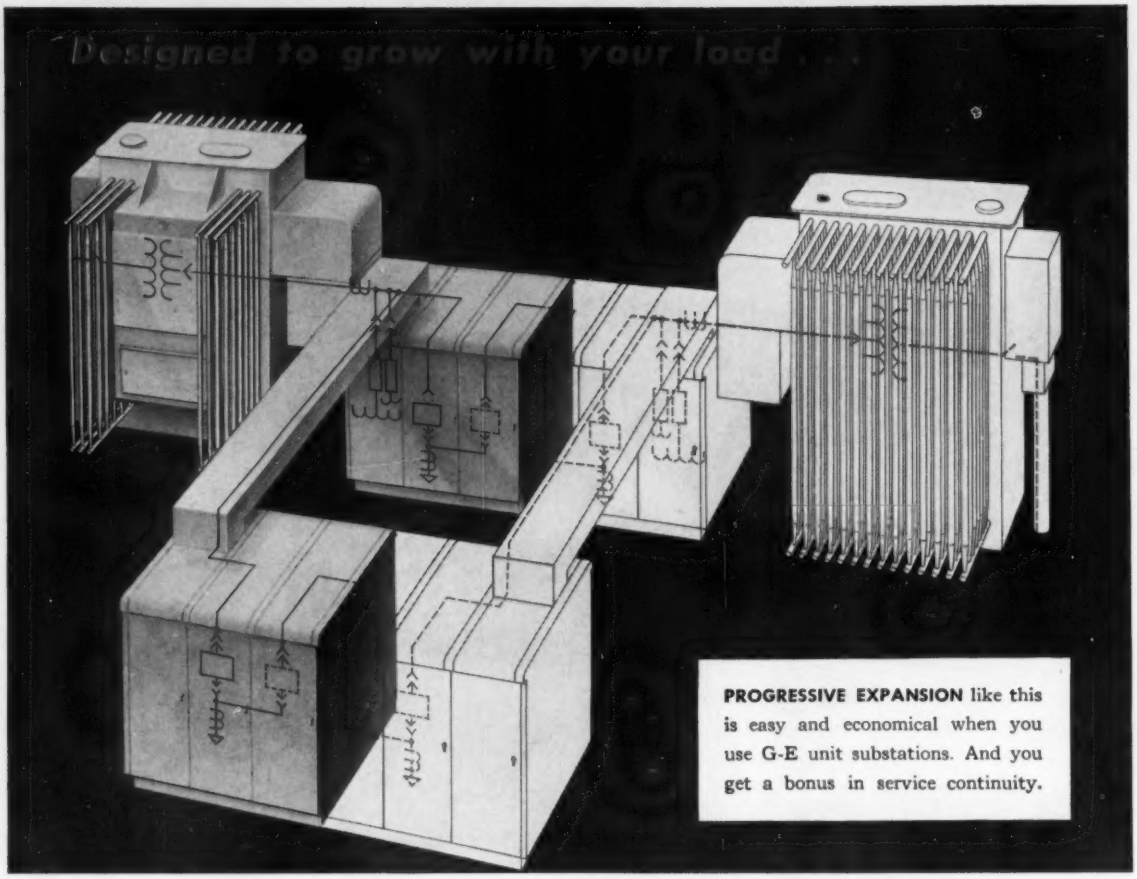
- **Coordinates with all hydraulic reclosers, regardless of make**
- **Completely sealed from moisture to reduce normal maintenance**
- **Interrupts in 1 to 2 cycles by "oil blast" operation**
- **Carries full 3-year warranty**

After nearly a year of development and testing, General Electric is proud to announce the availability of a completely new recloser . . . one that will coordinate with other hydraulic reclosers you may have on your line; one so perfectly sealed that it will not need maintenance for three years of normal operation; one that is designed and built to give the reliable operation you expect from G-E power circuit breakers; one with many new features that make installation and maintenance easy; and one that carries a complete three-year warranty on materials and workmanship.

For more information, contact your General Electric Apparatus Representative or write General Electric Company, Schenectady 5, New York.

493-2A

GENERAL ELECTRIC


Designed to grow with your load . . .
PROGRESSIVE EXPANSION like this is easy and economical when you use G-E unit substations. And you get a bonus in service continuity.

This G-E unit substation expands easily from radial to double-duplex hook-up

Circuit arrangement permits:

- **Lower equipment cost in initial and final installations**
- **Expansion to double-duplex without shutdown**
- **High degree of service continuity**
- **Bus regulation for each pair of feeders**
- **All switching performed by adequate circuit breakers**
- **Routine inspection and maintenance can be made without dropping load**

To meet growing loads, this General Electric two-feeder unit substation can be easily expanded into a double-duplex arrangement—a four-feeder substation that combines flexibility and service continuity with relatively low equipment cost. And this expansion is possible *without shutting down the substation.*

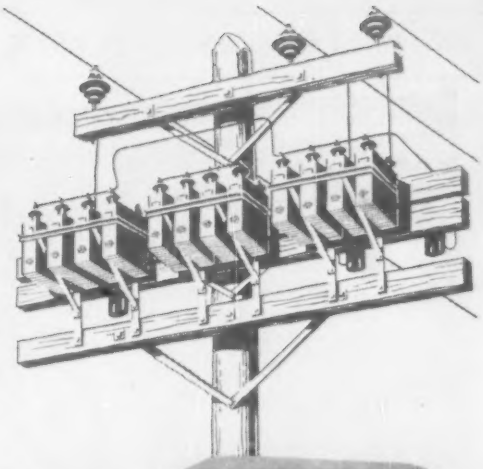
The double-duplex arrangement has the recognized advantages of the familiar "breaker-and-a-half" scheme at low cost per kva. The two normally open tie breakers with automatic throwover provide a high degree of service continuity. It is possible to remove either transformer or any breaker from service without dropping load. All switching operations involved are performed by adequate circuit breakers. Automatic-load-tap-changing equipment on each transformer provides bus regulation for each pair of feeders.

For more information about double-duplex, or other G-E unit substations designed to meet growing loads, ask your G-E apparatus representative for bulletins GEA-3800 and GEA-5847, or write to General Electric Company, Section 512-9, Schenectady 5, N. Y.

GENERAL ELECTRIC

Look to SANGAMO for Capacitor Controls

TO FIT YOUR NEEDS...

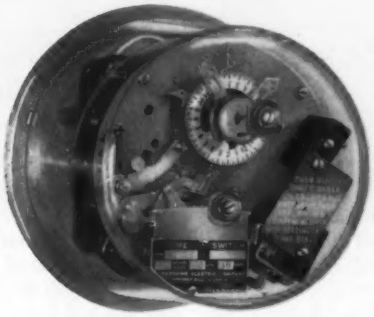


Whether you control capacitor switching as a function of Time, Amperes, Volts, Watts or Vars—Sangamo can furnish economical and reliable control equipment.

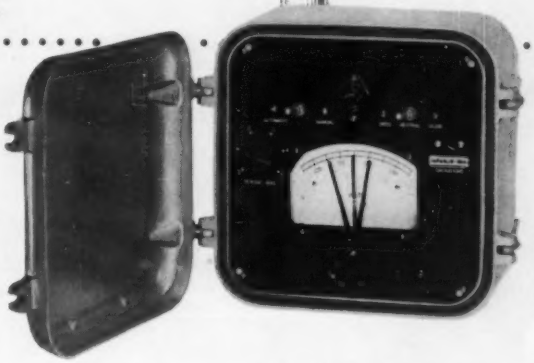
Sangamo Time Switches are synchronously operated and may be equipped with automatic carryover to keep them "on time" during current interruptions.

Sangamo LincolntrolS provide automatic capacitor switching in response to changes in circuit conditions.

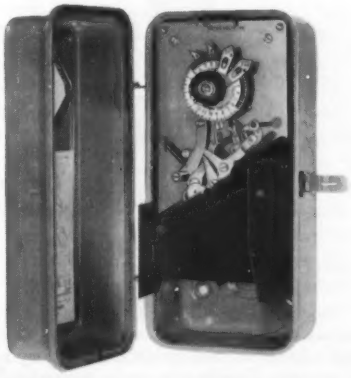
Ask your Sangamo Representative, or write us today.



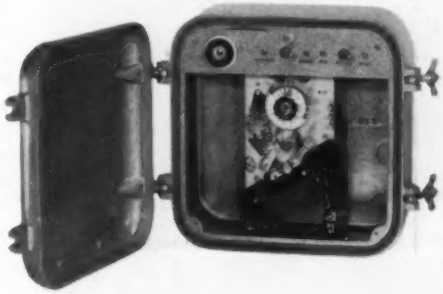
Type WS Synchronous-Carryover Time Switch for socket mounting.



Type VS Socket-connected LincolnIrols switch capacitors as a function of voltage. Type AS is sensitive to amperes, Type RS responds to kilovars. Bottom connected, as well as other mountings, are also available.



Type L Synchronous Time Switch in gasket-sealed case.

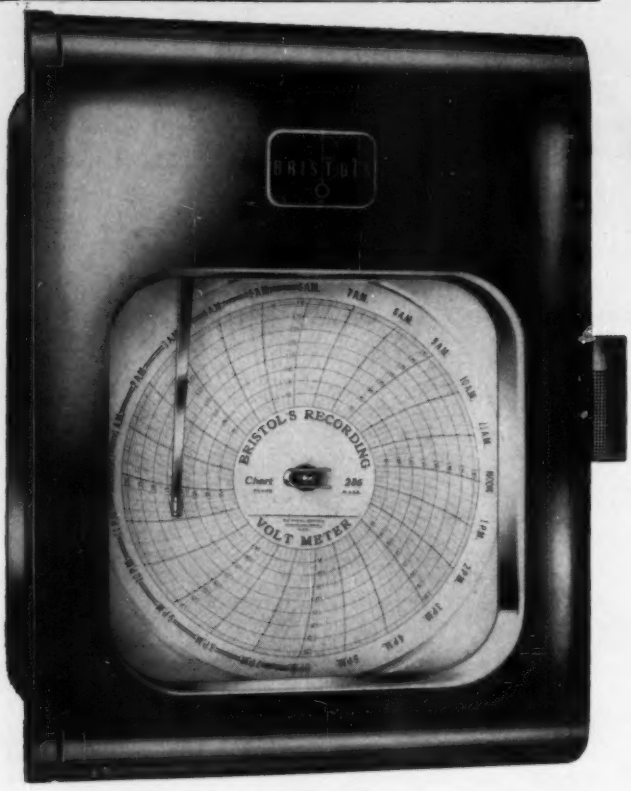


Type AW Synchronous-Carryover Time Switch for socket mounting, includes fuse and switches for manual and automatic operation.

SANGAMO ELECTRIC CO.

SPRINGFIELD, ILLINOIS

WHAT'S NEWS AT BRISTOL . . .



PERMANENTLY MOUNTED Bristol Voltmeters and Ammeters come in three models: interchangeable surface and flush, surface-panel, and flush panel.

How do you pick the right recording ammeter or voltmeter?

The *right* choice for any voltage or current measurement and recording job is a Bristol Series 500 instrument.

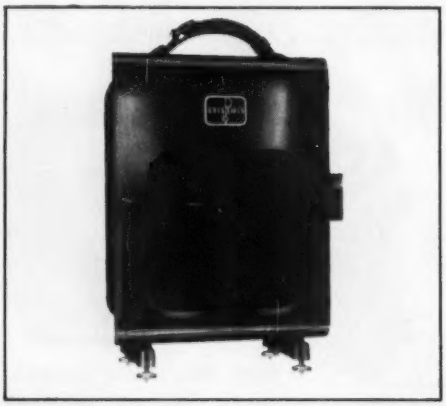
Why Bristol? Mainly because for sheer accuracy the Bristol Recorders can't be topped. Among the reasons for that are:

1. Low burden – the lowest burden of any round-chart recorder on the market.
2. Extremely high torque gradient.
3. Temperature compensated.
4. Shock-proof moving element mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording of sudden changes – up to full scale value.

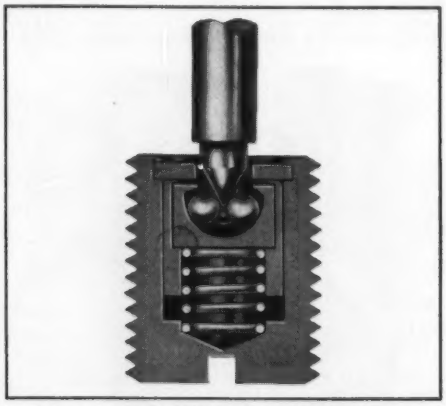
Also, Bristol's Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof cases; quick-set chart hub for each chart changing; and snap-on chart plate.

Models offered that comply with ASA Specification C39.2.

Want more facts? Write for Bulletin E1111 to the Bristol Company, 116 Bristol Road, Waterbury 20, Conn. 5.19



SINGLE AND TWO-PEN PORTABLE BRISTOL RECORDERS are offered in two models: one chiefly for portable pole mounting and the other for general portable service.



NEW BALL-BEARING SUSPENSION, loaded by a coil spring, prevents damage even under severe mechanical shock. Corrosion-resistant stainless steel ball bearings are almost tool-hard.

BRISTOL BRISTOL'S *POINTS THE WAY IN HUMAN-ENGINEERED INSTRUMENTATION*

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

ROADWAYS AND PARKING AREAS are lighted with L-M Spherolites® with mercury vapor lamps.

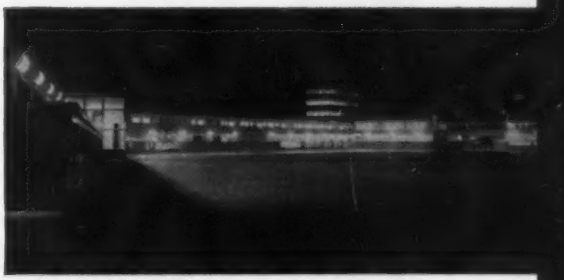
L-M Lights Roadways, Runways, and Ramps at General Mitchell Field

Milwaukee County's magnificent new air terminal at General Mitchell Field provides the latest facilities for comfort, convenience, and service of passengers flying in and out of the big midwestern metropolis.

The newly dedicated terminal is a beautiful low modern building nearly 1000 feet long. The arriving traveler finds such modern conveniences as automatic doors, escalators, the latest in lighting, a wide range of facilities for his comfort and convenience. The new airport is not only a great focal point for Milwaukee County but also a model for airline terminals everywhere.

Approach roadways and the huge 2000-car parking area are lighted by L-M mercury vapor units on steel poles. Loading ramps are illuminated by L-M's latest fluorescent luminaires, whose broad light sources provide ample illumination with a minimum of glare to incoming pilots. Runways for planes are marked with L-M's high intensity Thermal Beam™ runway lighting units.

L-M provides a complete line of incandescent, mercury vapor, and fluorescent lighting and equipment for outdoor installations—for street lighting, airports, roadways, shopping centers, parking areas. L-M's runway lights are the culmination of years of development by the leader in airport runway lighting. For complete information on L-M products and services, ask the L-M Field Engineer or Lighting Engineer; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).



RAMP LIGHTING—154 of L-M's new fluorescent units provide a high level of illumination without glare to pilots.

RUNWAY LIGHTS—L-M's Thermal Beam units compensate in both intensity and direction for fog and other low-visibility conditions, by toeing in as intensity is stepped up, toeing out as intensity is lowered in clear weather. Smaller L-M lights light taxiways.

LINE MATERIAL

Street and Airport Lighting

The lamp and socket swing down as part of the glassware assembly, become automatically de-energized for quick, Service-Safe re-lamping during circuit operation.

The refractor assembly swings wide open on the house side, for easy re-lamping. Refractor assembly can be removed easily but not accidentally.

Make-before-break action of contacts . . .

L-M's New Series Ovalite is Automatically De-Energized with New Service-Safe Feature

Both lamp and socket are automatically de-energized and isolated from series circuit when glassware swings down. Make-before-break action of contacts in series luminaire eliminates arcing.

By **DEAN W. MORRILL**, Lighting Application Engineer, Line Material Company

L-M's new mercury vapor Ovalite offers outstanding design features for safe, economical servicing of the luminaire, in addition to its efficient light distribution.

The lamp and socket swing down as part of the glassware assembly; as the socket leaves the receptacle, it becomes automatically de-energized, and much more accessible for quick, safe re-lamping of the luminaire during circuit operation, saving service time.

Contacts on the series Ovalite are so designed that there is a make-before-break action, which means the lamp connections are shunted before they are disconnected. In restoring the connection the same principle applies. The lamp connection is made before the shunt is opened, eliminating arcing.

The contacts are silver-plated beryllium copper; socket is steatite; receptacle is wet-process glazed porcelain with a 5,000-volt insulation rating which meets EEI-NEMA specification of 19,000 volts withstand.

This new Ovalite provides a choice of horizontal or pendant mounting for mercury vapor; choice of types III or IV light-distribution patterns.

The Service-Safe feature of L-M's Ovalite is available in both multiple and series luminaires.

Get Complete Information

This series luminaire is specifically designed for the Uni-Ballast system. Ask the L-M Field Engineer or Lighting Engineer for information on the new L-M Ovalite; on Uni-Ballast, the most economical system for mercury vapor lighting; and on L-M's Lighting Recommendation Service. Or write Line Material Co., Milwaukee 1, Wis. (a McGraw Electric Company Division).

"Ovalite," "Uni-Ballast" and "Service-Safe" are Line Material Company trademarks.

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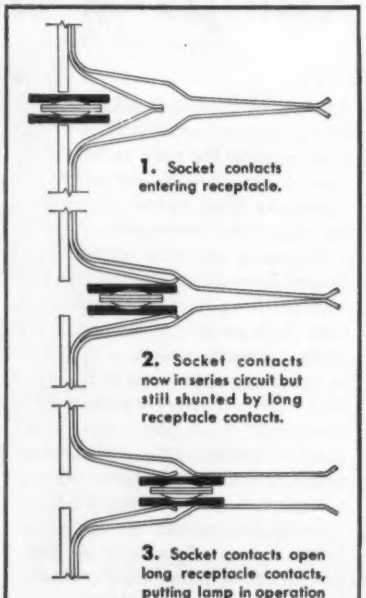


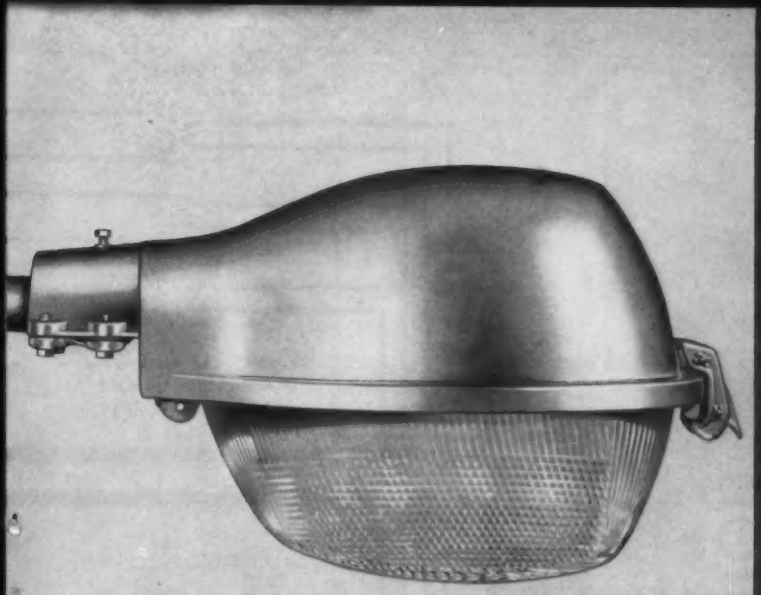
1. Socket contacts entering receptacle.

2. Socket contacts now in series circuit but still shunted by long receptacle contacts.

3. Socket contacts open long receptacle contacts, putting lamp in operation in series circuit.

NOTE—Procedure is reversed when socket is withdrawn during luminaire opening. Lamp is shunted before being withdrawn from circuit. This make-before-break action eliminates arcing.

LINE MATERIAL
Street Lighting



L-M's new mercury vapor Ovalite has high co-efficient of utilization on the street side, with a choice of types III or IV asymmetric light distribution merely by changing glassware.

Lamp and socket swing down, become automatically de-energized for quick, Service-Safe re-lamping during circuit operation.

Wiping-action contacts open circuit on multiple unit...

Now Quick Re-Lamping Possible with Ovalite's Automatic De-Energizing Feature

New Service-Safe design automatically isolates lamp and socket from circuit. As luminaire is closed, circuit is completed by means of wiping-action silver-plated beryllium copper contacts.

By **STACY STANDLEY**
Manager of Lighting Sales
Line Material Company

Here's a new feature in luminaire design that offers savings in servicing. L-M's Ovalite lamp and socket are automatically de-energized and isolated to provide quick, safe re-lamping of the luminaire during circuit operation.

The lamp and socket are part of the refractor assembly. On this multiple unit, wiping-action contacts open as the assembly is swung down, isolating the lamp and socket from the circuit and providing easy, safe access to the luminaire. The wiping action keeps the contacts clean.

The Service-Safe feature is also available on L-M's series Ovalite. This series Ovalite has a shunting make-before-break action.

Other Outstanding Features of L-M's Ovalite

Choice of type III or IV light-distribution pattern by simply changing the glassware.

High co-efficient of utilization on street side.

Latch automatically assures positive closing of luminaire when refractor is pushed up.

Both latch and hinge have a spring action to hold the refractor firmly against the gasket, assuring a bugproof, dustproof, and weatherproof seal.

Complete refractor assembly can be removed easily when desired, cannot be accidentally unhooked.

Hood is a smoothly finished one-piece aluminum casting.

One-piece aluminum reflector.

All hardware is stainless steel or non-ferrous metal.

No trapped light at the glassware junction.

Reflector and refractor are easily cleaned.

Get Complete Information

Ask the L-M Field Engineer or Lighting Engineer for information on the new L-M Ovalite, and on L-M's Lighting Recommendation Service. Or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division.)

"Ovalite" and "Service-Safe" are Line Material Company trademarks.

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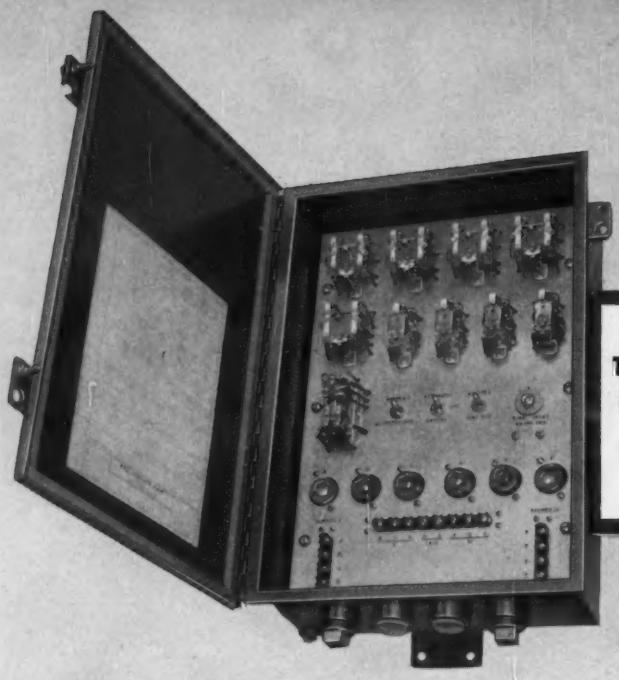
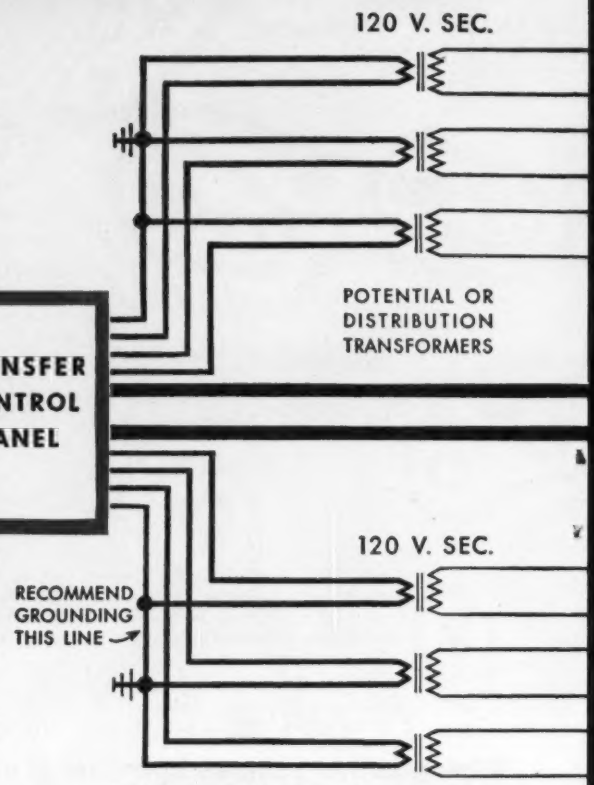
LINE MATERIAL *Street Lighting*



TYPE S TRANSFER CONTROL

L-M's Type S automatic load transfer control is completely enclosed in weatherproof steel cabinet. It is designed to operate with L-M's single-phase Type NR switch, heavy-duty Type R three-phase recloser, or L-M's new three-phase heavy-duty Type VR switch.



NOTE: Control may also be furnished for single-phase sensing, is recommended if three-phase protection is provided in each feeder.

NOTE: For simplicity, protective equipment (fuses, lightning arresters, etc.) are not shown.

Automatic Load Transfer Control For 4-Wire Wye System—Three-Phase Sensing

The diagram above shows a typical load transfer scheme. Below is the operating sequence using L-M's new Type VR switch and Type S transfer control panel. This provides an economical and dependable method of assuring service continuity.

Operation of the Three-Phase Sensitive Control

1. Assume load is connected to Source I and potential on either phase A, B, or C is lost. If either X, Y or Z is not energized, no switching occurs. If X, Y & Z become or are all energized, VR on I opens and VR on II closes, after time delay, thus transferring load to other feeder.

2. Assume control is set for "Source I preferred," load is connected to II, and X, Y & Z are energized. If energy returns to A, B & C, VR on II opens and VR on I closes, after time delay.

Assume control is set for "no preference," load is connected to II, and X, Y & Z are energized. If A, B & C are energized, nothing happens. If X, Y or Z then loses potential, after time delay VR on II opens and VR on I closes.

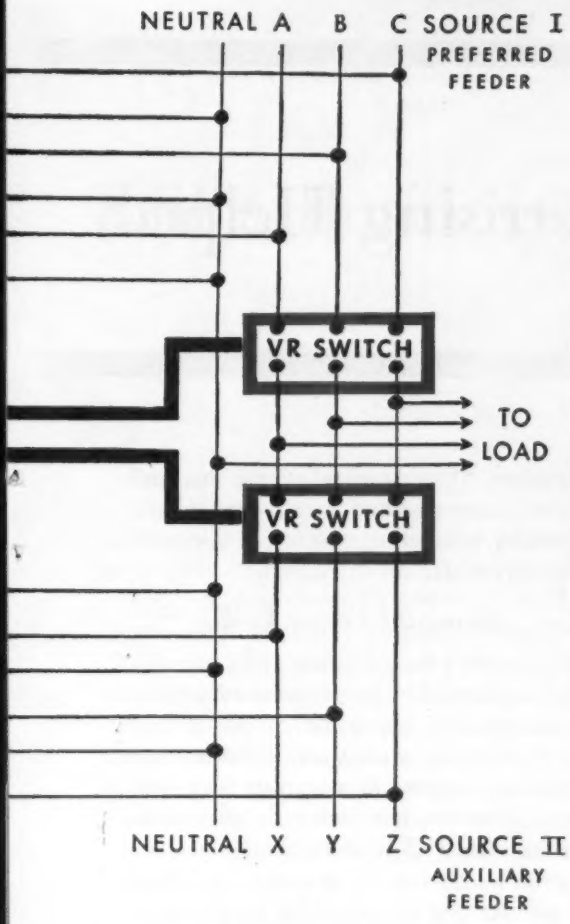
3. Control is sensitive to three-phase energy. It seeks to disconnect single- or two-phase service but will remain on the same source if the other source is not three-phase.

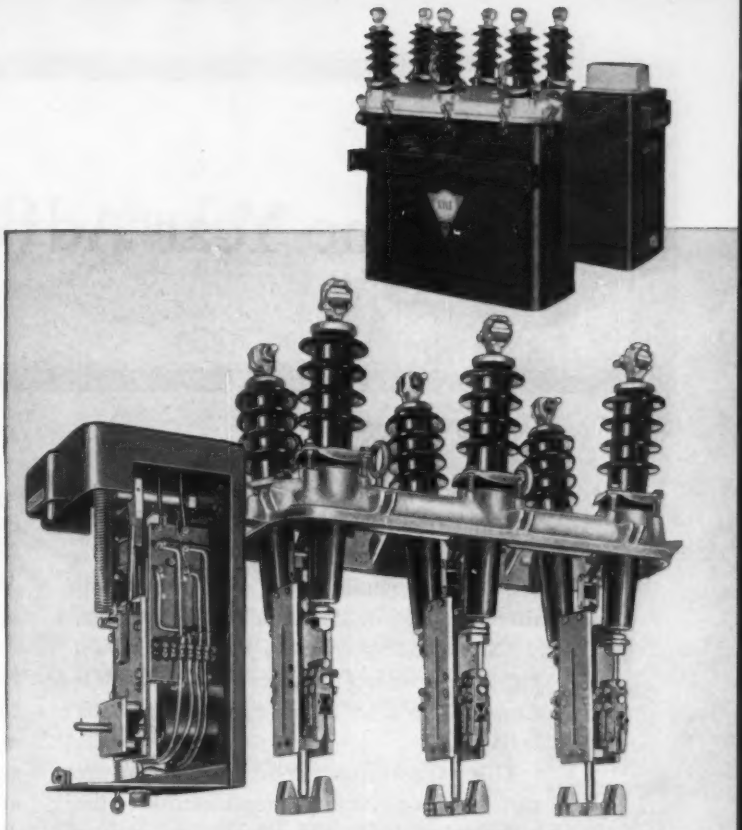
4. Electrical interlock insures that VR I is open before the other switch begins to close. This applies to both automatic and manual motoring operations.

5. Manual switches provided inside cabinet to transfer load to either source. Another switch selects "Source I preferred" or "no preference."

6. Time delay adjustable up to approximately one minute; longer delay (up to 5 min.) available on special order. Same delay, either direction of transfer. Delay should be set to prevent false operation on transient conditions.

LINE MATERIAL





VR SWITCH L-M's new heavy-duty Type VR switch is rated at 14.4 kv RMS, with a 110 kv BIL, a 20,000 ampere momentary rating and a 400 amp thermal rating. Simultaneous clearing of all phases in 3 cycles. Solenoid operates on 120 volt secondary, requires 1.5 amps to trip.

Automatic Switching...

L-M's New Load Transfer Equipment Assures Service Continuity To Important Loads

By **FRANK McSTAY**
Product Manager
Kyle Products
Line Material Company

Distribution systems are being called upon to be even more reliable in supplying power to important loads. Hospitals, radio and television stations, government and many industrial loads must have better service continuity.

L-M's new Type S automatic load transfer control and Type VR heavy-duty oil switch provide an excellent means for automatically switching important loads during feeder outages.

Automatic Load Transfer Control

The Type S control is a pre-assembled, pre-wired relay device which is completely enclosed in a weatherproof steel cabinet. It is quick and easy to install.

Adjustable time-delay relays are used in L-M's Type S controls to prevent false operation on transient conditions. An interlock mechanism in the control circuit permits load transfer to the auxiliary feeder only after the switch has disconnected the faulted feeder. The interlock is also arranged so that the Type S will transfer the load only when the auxiliary or standby feeder is energized.

The Type S control is extremely versatile. It will operate with L-M's single-phase 200 ampere Type NR switch, with the heavy-duty Type R three-phase recloser, or with L-M's new three-phase, heavy-duty Type VR switch. The type S can also be applied to automatic reclosing circuit breakers which have been slightly modified.

Heavy-Duty, Three-Phase Oil Switch

L-M's new remote control Type VR oil switch is a 14.4 kv 400 ampere heavy-duty switch, designed for capacitor switching, distribution feeder sectionalizing, and automatic load transfer applications. The Type VR has a 110 kv BIL with a 20,000 ampere momentary rating. The unit trips and clears all three phases simultaneously in three cycles.

An auxiliary switch is available with the VR or can be added in the field. It may be a one, two, three, or four stage unit, used for remote-position indicating or low-voltage-control switching of apparatus used in conjunction with the VR switch.

Get bulletins and complete information on new load transfer schemes and equipment from your L-M Field Engineer, or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Kyle® Switchgear

The Year Advertising Helped

IN 1954 we had a business recession in the United States. Sales fell about 4% during the year. If management had followed the historic pattern of business ups and downs, advertising volume would have fallen much further.

But in 1954 the volume of advertising did not fall. It increased over 5%. Every effort was made to stimulate sales when sales were needed to sustain prosperity.

This was something entirely new under the sun. It had a powerful influence in making the recession of 1953-54 one of the mildest on record. It helped greatly to speed business on to the record-breaking levels it has attained today.

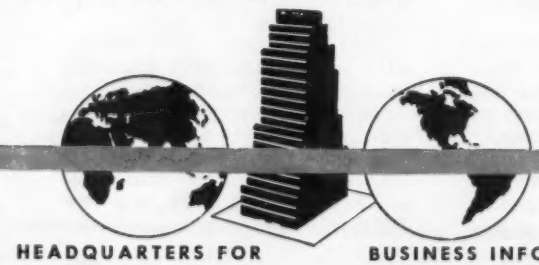
There are several reasons why America's business management attacked this decline in sales with more advertising. One of them grew out of the greatly strengthened position of the American consuming market. Consumers' income after taxes has been rising an average of over $10 billion a year since 1946, and this rising income is more widely distributed than ever before. Furthermore, consumers have piled up reserves of about $215 billion in cash or its equivalent. These reserves offer a new and powerful inducement to increased selling and advertising effort even in the face of a possible decline in consumer income.

Taking the Longer View

However, the principal reason why a sales decline was attacked with increased advertising is management's new-found conviction that good advertising is essentially an investment in the development of a market. Successful development requires sustained investment. The inclination of business management to take this longer view, is, of course, motivated by the fact that the American market, with over 3 million consumers being added annually, is growing at a prodigious rate.

Ten years ago only a handful of companies had plans for investment in new producing facilities extending beyond the current year. Today almost all leading companies have investment programs running some years ahead. And keeping pace with these long-range business investment plans has been the development of sales and advertising programs to

McGraw-Hill
PUBLISHING COMPANY, INC.
330 West 42nd Street, New York 36, N. Y.



HEADQUARTERS FOR BUSINESS INFORMATION

Kill a Business Recession

reach tomorrow's greatly expanded markets.

This crucial role of advertising in providing driving power for our economy is gaining greater recognition every day. In his recent book, "People of Plenty," Professor David M. Potter of Yale University remarked: "Advertising is not badly needed in an economy of scarcity, because total demand is usually equal to or in excess of total supply, and every producer can normally sell as much as he produces. It is when potential supply outstrips demand—that is, when abundance prevails—that advertising begins to fulfill a really essential economic function."

Advertising's Key Role

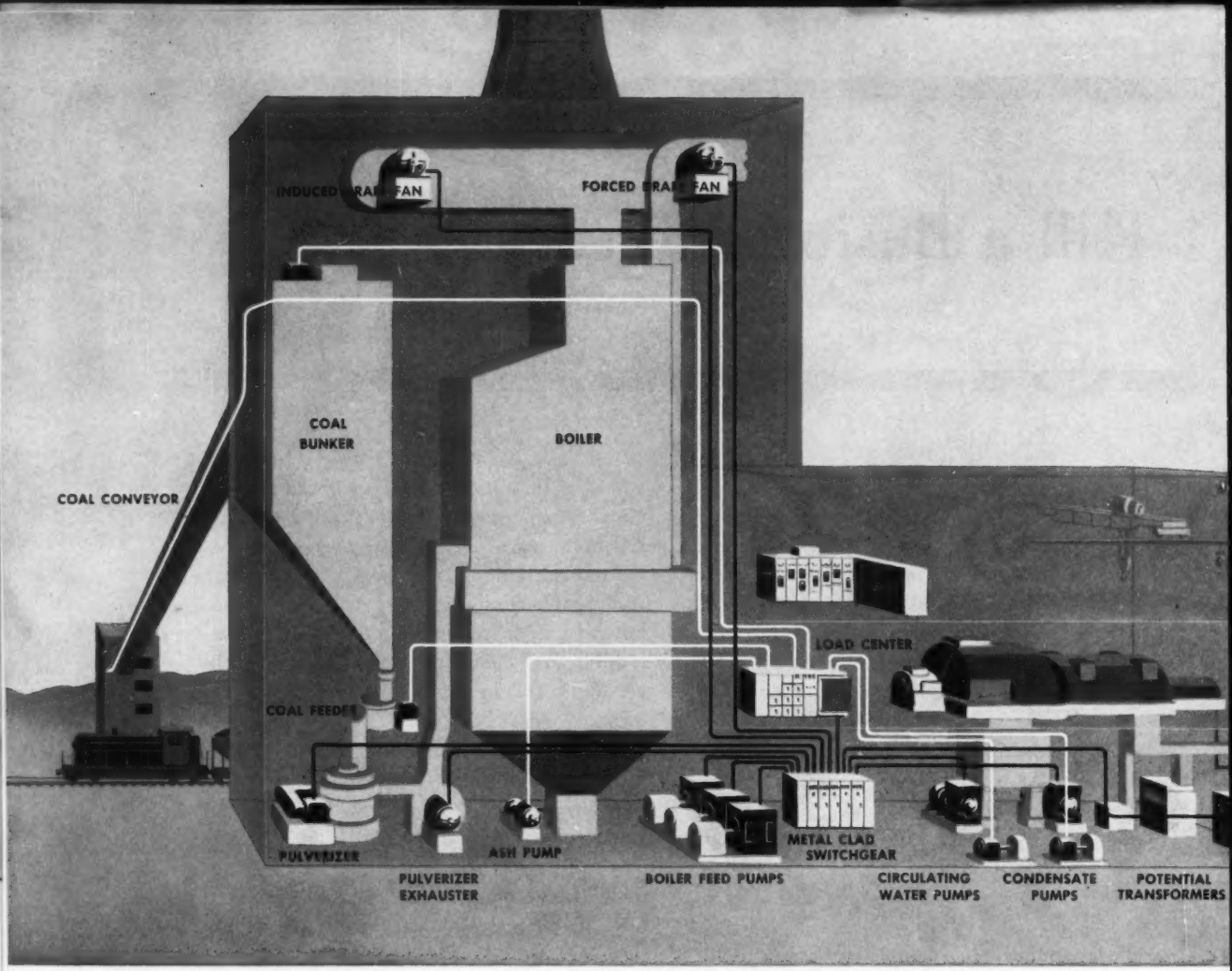
Today abundance so completely prevails in the United States that it has been conservatively estimated that as much as a third of everything offered for sale falls in the realm of "optional consumption." That is, consumers can "take it or leave it" without any immediate personal inconvenience. But if they decide to "leave it," a terrific economic depression will not be far behind. In such circumstances, advertising—in which, in all of its forms, we are now investing about $9.2 billion annually—clearly is of crucial importance to our continued prosperity.

In performing its key role in past years, American advertising never realized its full potential. It successfully promoted sales. But it never was called upon to promote an overall economic stability as a direct outgrowth of increased sales.

By successfully promoting both sales and economic stability, as it did in 1954, advertising surely has added new strength to the American economy. It has also added a great new and constructive dimension to advertising itself. This accomplishment makes the celebration of our first National Advertising Week (February 19-25) a particularly notable occasion.

One of the surest means of expanding your sales volume in today's $150 billion *industrial* market is through dominant advertising in the publications directly serving your major customers and prospects.

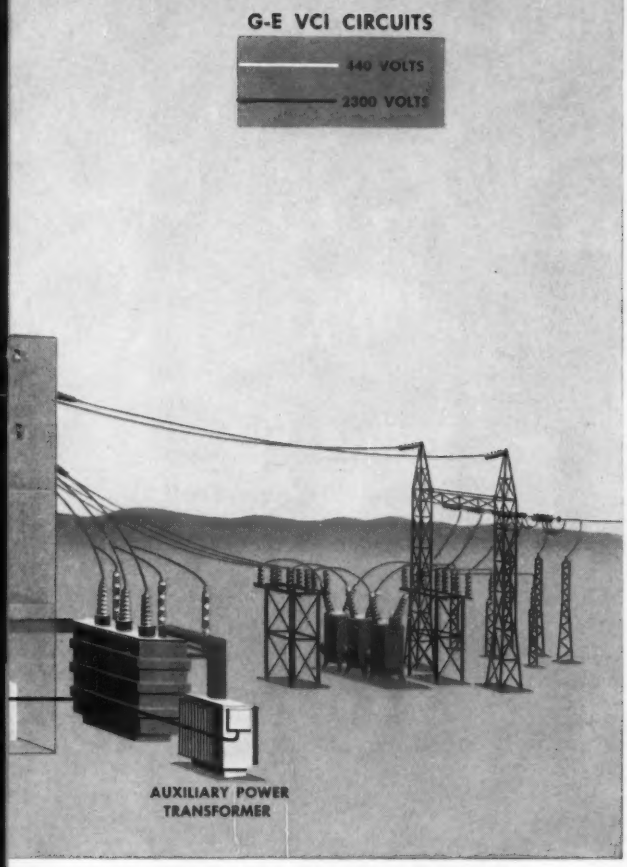
McGraw-Hill's business and technical publications can give you quick access to the men who initiate, specify and approve the purchases of industrial products and services. Because all are leaders in their respective fields, you are assured a maximum return on your investment when you specify a McGraw-Hill publication to carry your advertising to your most important markets.



G-E VCI cable for station auxiliaries and material costs and provides

In planning today's modern generating stations to meet present and future needs, utility engineers give careful consideration to the selection of cables. They know that the choice of the proper cable can effect saving in material cost, ease and economy of installation, space saving, accessibility, and greater latitude in the placement of auxiliary equipment.

To attain these important objectives, leading electric utility companies are using General Electric varnished-cambric interlocked armor cable for station auxiliary cables. G-E VCI cuts material and installation costs, does not require conduit, and eliminates extensive engineering layout time. Because of its flexibility, G-E VCI cable provides for easy changes in location during construction or service. Its accessibility in open racks makes it easily avail-

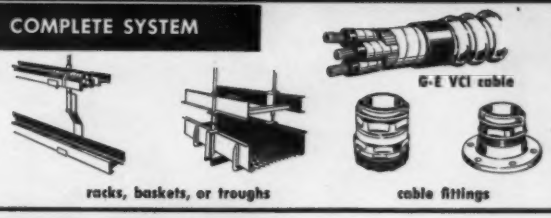


cuts installation for future growth

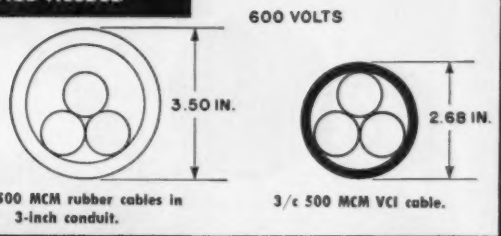
able for visual inspection or relocation.

You'll find some of G-E VCI's outstanding advantages illustrated on the right. For more specific information on how G-E VCI can cut installation and material costs in either industrial plants or generating stations, write Section W168-227, Wire and Cable Department, General Electric Company, Bridgeport 2, Connecticut.

A COMPLETE SYSTEM

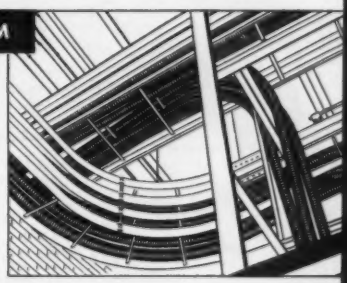


LESS SPACE NEEDED



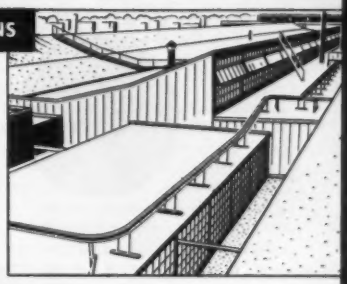
CORNERS ARE NO PROBLEM

VCI can be bent around corners and over beams without elbow fittings.

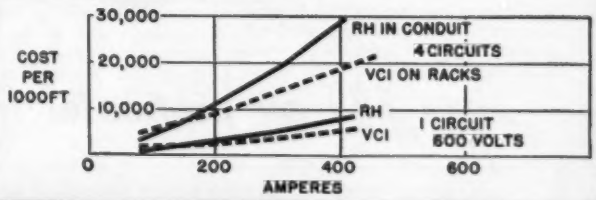


LONGER CONTINUOUS RUNS

G-E VCI can be pulled in long lengths over roofs, down shafts, across areaways without splices or joints.



LOWER MATERIAL COST

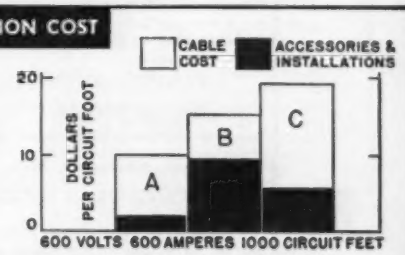


REDUCED INSTALLATION COST

A. Two 3/c 350 MCM VCI cables in parallel.

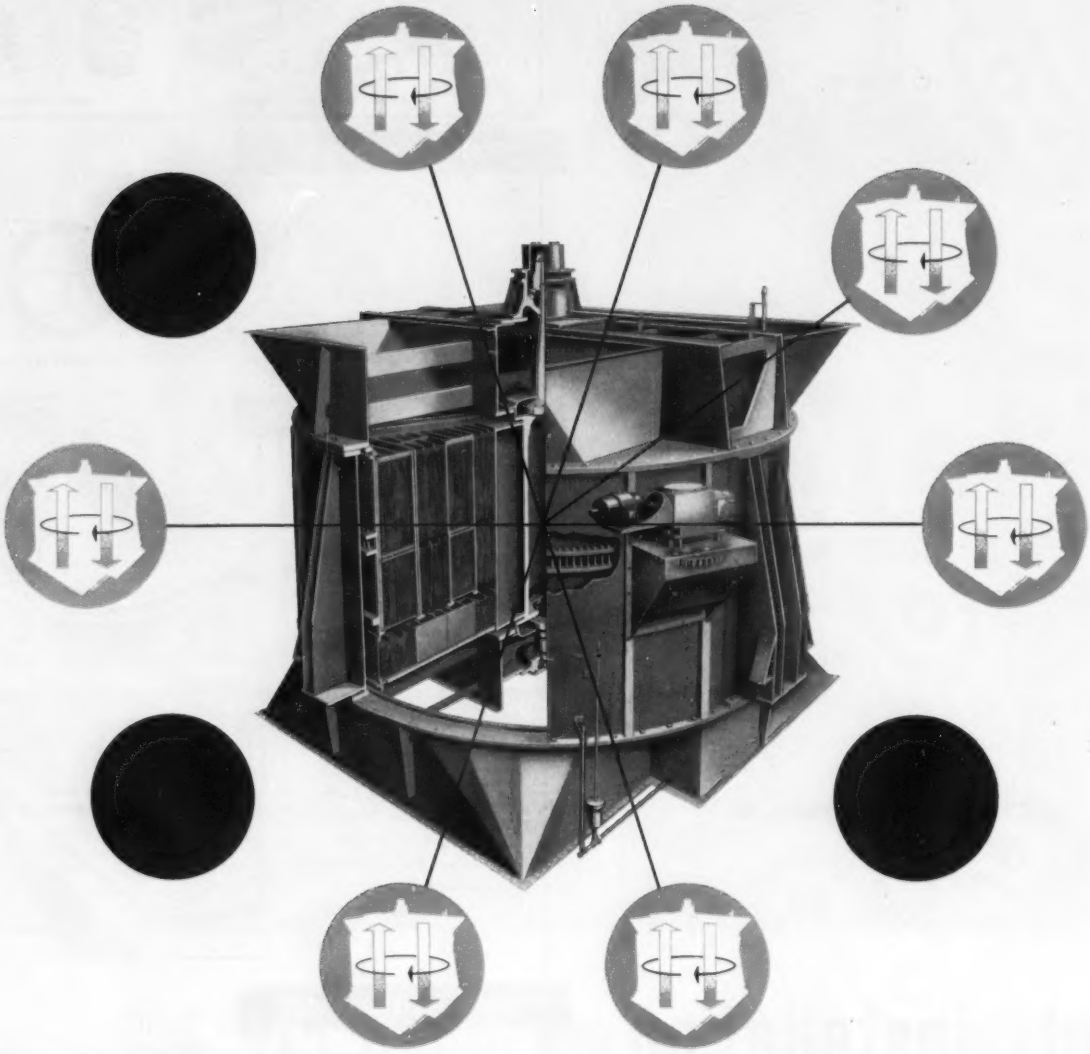
B. Two 1/c 350 MCM cables per phase, in conduit.

C. Bus.



Progress Is Our Most Important Product

GENERAL ELECTRIC



7 out of 10 air preheater installations are Ljungstrom®

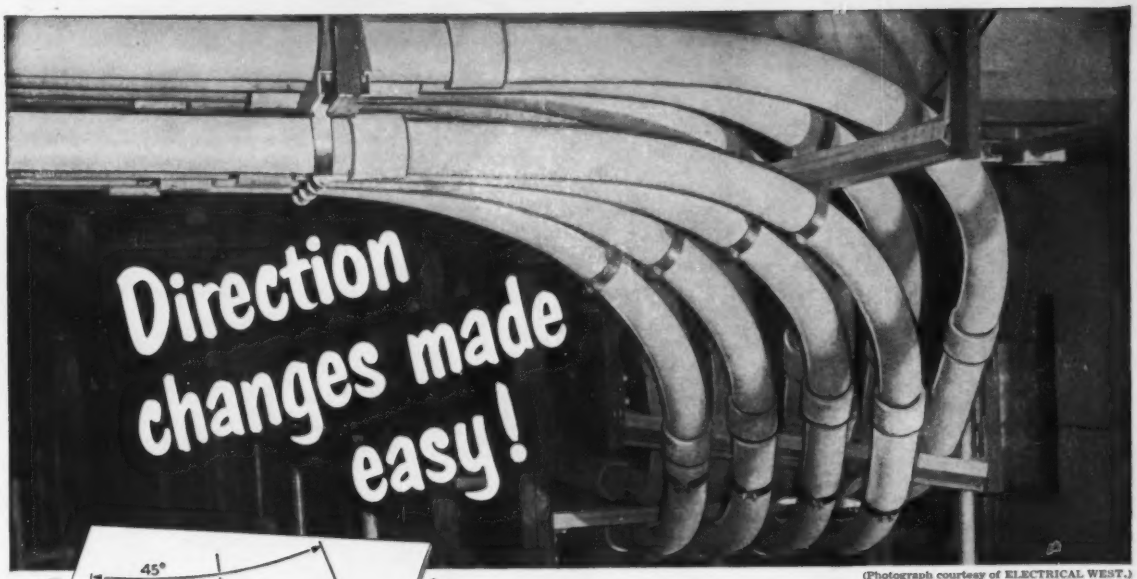
Advantages of the Ljungstrom Air Preheater

- Size for size, recovers more heat than any other type.
- Reduces fuel consumption. Permits use of lower-grade fuels. Increases boiler output and reliability.
- Eliminates cold spots . . . keeps corrosion to a minimum.
- Easier, faster to clean and maintain.
- Requires far less supporting steel and is quickly erected.

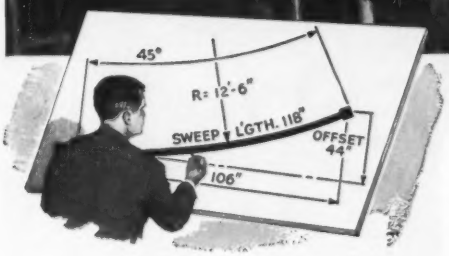
FUEL ECONOMY is the big reason. Size for size, the Ljungstrom recovers more heat than any other type of air preheater. And with every 45-50 F of air preheat you cut your fuel bill 1%.

Write now for your copy of our 38-page manual, for handy reference.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.



(Photograph courtesy of ELECTRICAL WEST.)

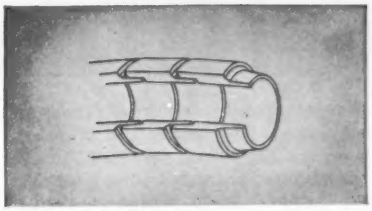


. . . with standard fittings for TRANSITE asbestos-cement DUCTS

When you use Transite Ducts, you have available a wide variety of standard fittings, made of the same asbestos-cement material as the ducts themselves. These fittings save time and expense because they provide maximum flexibility in laying out or constructing a duct system. They facilitate clearing unexpected obstructions or accommodating revisions in the original layout.

For instance, the new Transite 5° Bend Segments (shown at left) can be used alone to form simple and complex curvatures of any multiple of 5°. Used with other standard Transite curved fittings, they form curvatures of odd degrees. Thus, they enable you to simplify cross-overs and transformations . . . to clear obstructions . . . to form unusual or special bend or offset sections. They eliminate the need for purchasing special radii bends or sweeps. The other standard Transite fittings that facilitate directional changes are the offset bends, standard 45° and 90° bends, sweeps, curved segments, laterals, tees, elbows and deflection couplings.

For complete information write for new brochure EL-45-A, "Fittings and Dimensions of Transite Ducts." Contains all dimensional data required by the designer. Also available, "Transite Duct Underground Installation Sheet," EL-43-A. Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto, Ontario.



5° bend segment sketched in detail. It consists of a straight section of Transite stock with a male taper on one end and a female taper on the other . . . each machined at an angle of 2½° to the center axis. Segments can thus be used single, or combined to form bend sections whose curvature is any multiple of 5°.

Photograph showing use of bend segments and curved segments with Transite Ducts.

5 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. Corrosion-Resistant. Transite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.

2. Permanently Smooth Bore. Transite makes long cable pulls easy, under any conditions. Danger of damage to cables is also minimized.

3. Incombustible. Transite will not burn or contribute to formation of smoke, gases, fumes. It confines burnouts, will not soften under heat.

4. Higher Thermal Conductivity. Cables run cooler in Transite, reducing I^2R losses, increasing current capacity and prolonging insulation life.

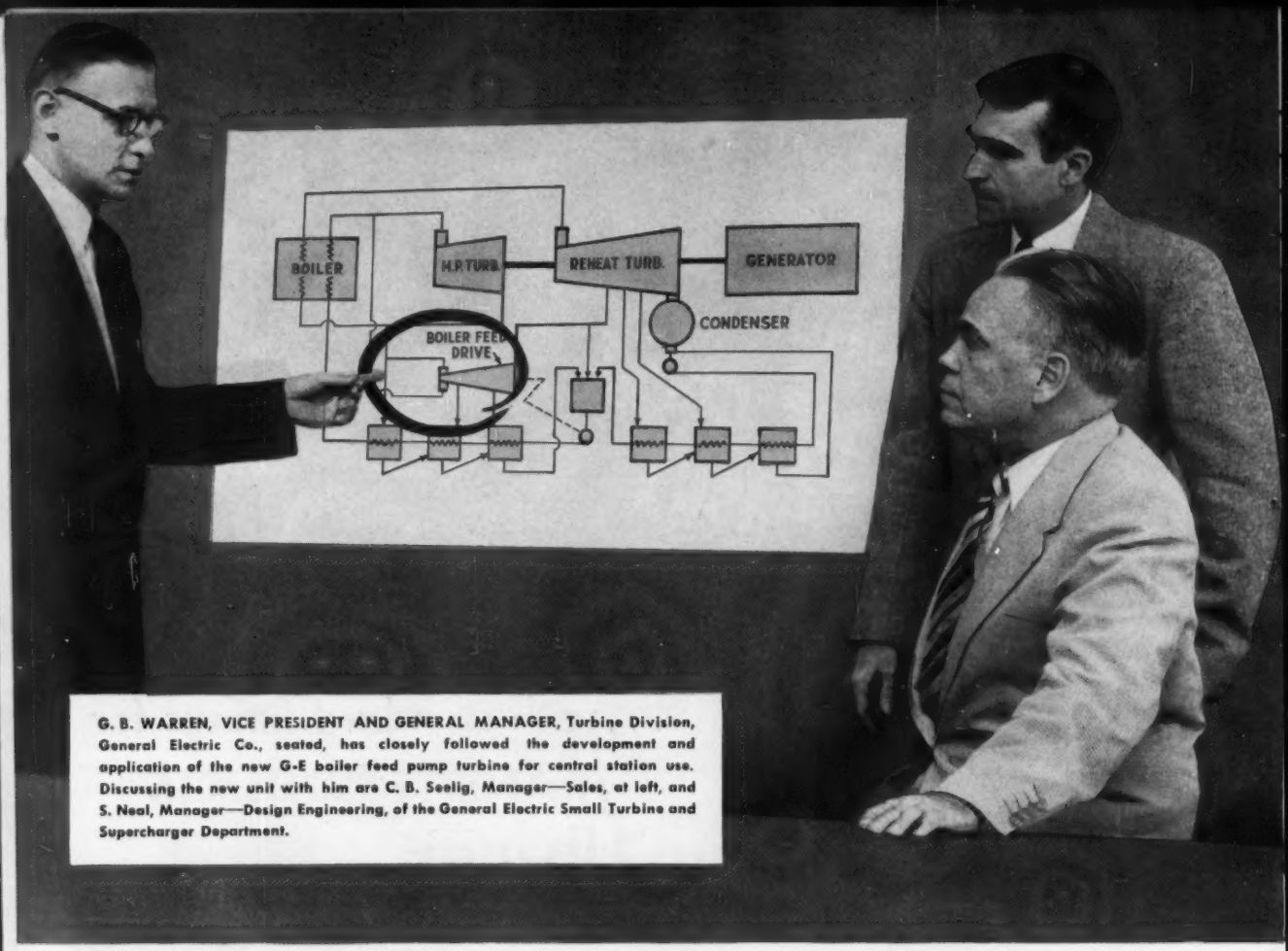
5. Easy to Install. Transite Ducts are light weight, easy to handle. Joints are quickly made. Long 10-foot lengths reduce number of joints in line.

Johns-Manville TRANSITE® DUCTS

JOHNS-MANVILLE JM PRODUCTS

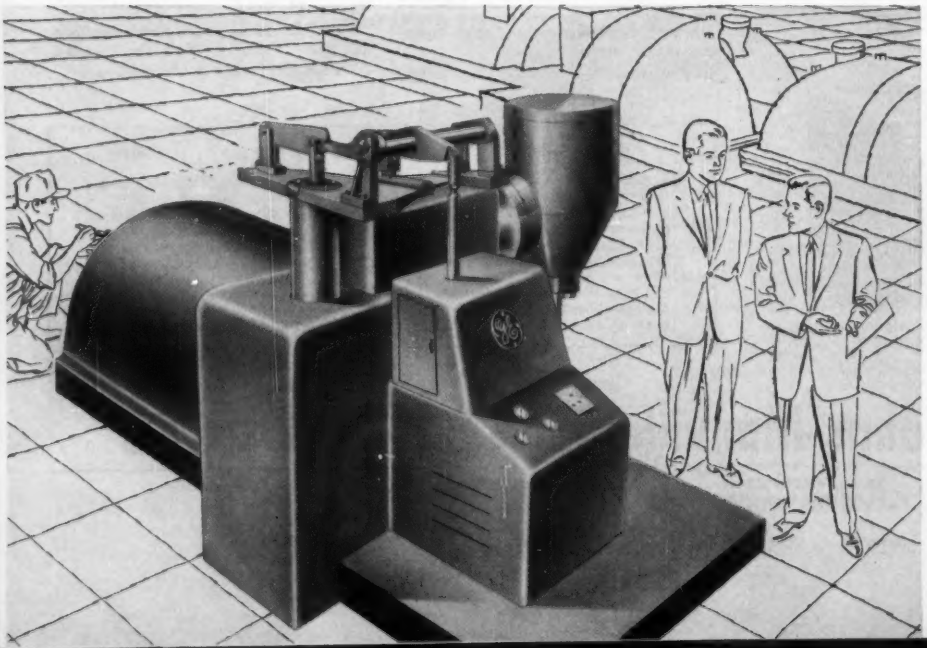
TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement



G. B. WARREN, VICE PRESIDENT AND GENERAL MANAGER, Turbine Division, General Electric Co., seated, has closely followed the development and application of the new G-E boiler feed pump turbine for central station use. Discussing the new unit with him are C. B. Seelig, Manager—Sales, at left, and S. Neal, Manager—Design Engineering, of the General Electric Small Turbine and Supercharger Department.

FOR THIS PARTICULAR APPLICATION ARRANGEMENT the high-speed turbine taps steam from the cold reheat line and exhausts to the heating system of the main turbine. By directing the exhaust from the boiler feed pump drive turbine to the main feed-water heating cycle, good plant heat rates are achieved under normal loading conditions. Since the reheater flow is reduced, savings may be achieved in reheat piping. During start up and light load operation, steam from the main boiler is admitted through auxiliary valving to the boiler feed pump turbine.



THIS TURBINE CAN INCREASE YOUR NET SALABLE KILOWATTS. It is one of a new line of General Electric turbines for driving boiler feed pumps in the 4000- to 10,000-hp range at speeds up to 9000 rpm.

HIGH-SPEED TURBINES

Announcing...

The NEW General Electric High-speed Turbine for Boiler Feed Pumps

GENERAL ELECTRIC has developed **a new turbine** especially designed to drive boiler feed pumps. This is the result of a thorough study which proved that such a turbine can bring significant advantages to electric utilities.

Because of today's trend toward increasingly higher pressures in high-output steam-electric generating plants, General Electric feels that mechanical-drive turbines can now be economically justified as boiler feed pump drives. Feed pumps for such plants now require 5000 to 10,000 hp at high speeds.

THE VARIABLE-SPEED CHARACTERISTICS of turbines are also particularly adapted to boiler feed pump control. This new concept in power station engineering is practical from both an operational and economical standpoint.

HERE IS HOW STEAM STATIONS CAN PROFIT using these new G-E turbines: Auxiliary power normally supplied by the main generator for motor-driven feed pump drives can now be released as salable kilowatts. This increase in salable power is available at relatively little incremental investment.

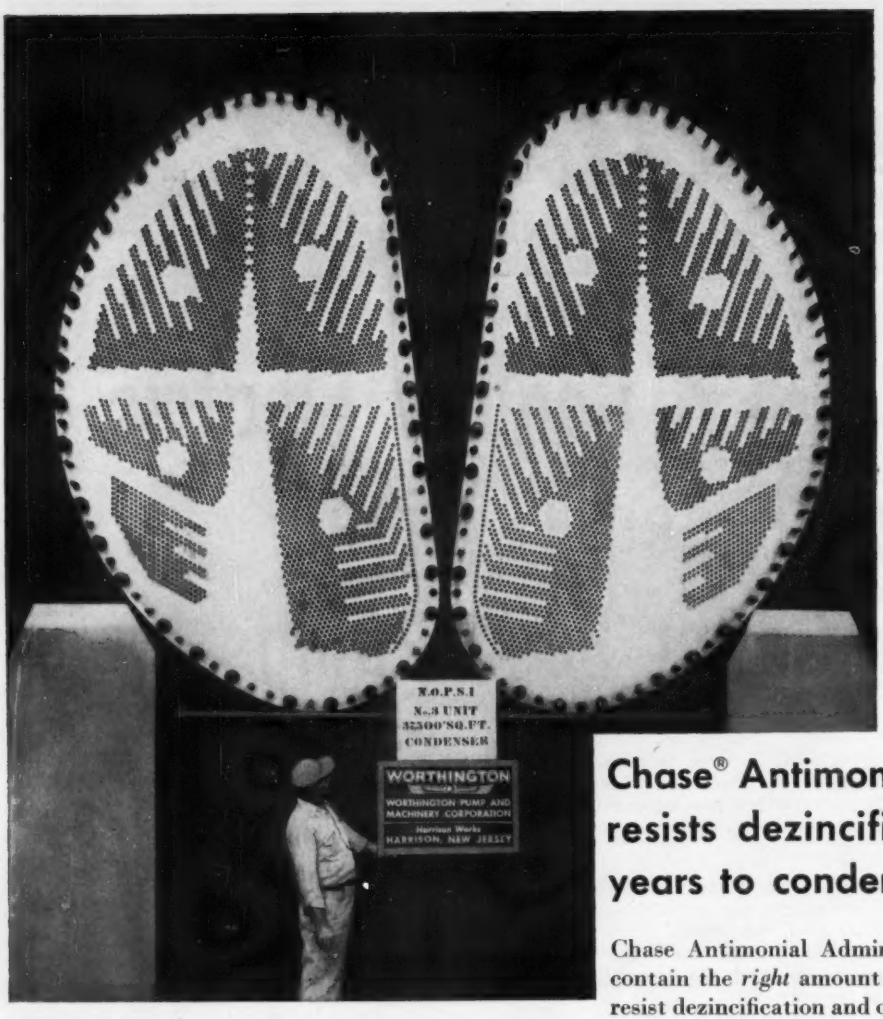
This design, the latest addition to General Electric's complete line of high-speed turbines, is built for easy operation and highly reliable service. Several utilities have already purchased a number of these units.

THE SCHEMATIC DIAGRAM shows one way in which G-E boiler feed pump turbines can fit into a typical steam station system. For additional information on how these turbines can be applied in your specific plant, contact your nearest G-E Apparatus Sales Office or write General Electric Company, Small Turbine and Supercharger Department, Fitchburg, Mass. 241-4

Progress Is Our Most Important Product

GENERAL ELECTRIC

RUGGED!



Chase® Antimonial Admiralty resists dezincification—adds years to condenser tube life!

Chase Antimonial Admiralty Condenser Tubes contain the *right* amount of antimony needed to resist dezincification and other forms of corrosion. That's why *Chase* tubes last so much longer!

And antimony will *not* weaken the tube in other ways! That's why *Chase* tubes *stay* sound through years of adverse conditions in the field!

When you replace Condenser Tubes, or plan a new installation, get the benefit of *extra* years of service. Insist on Chase Antimonial Admiralty.

Learn more about corrosion problems, and how Chase can help solve them. Send for free Chase Condenser and Heat Exchanger Tube Booklet.

Chase®

BRASS & COPPER CO.

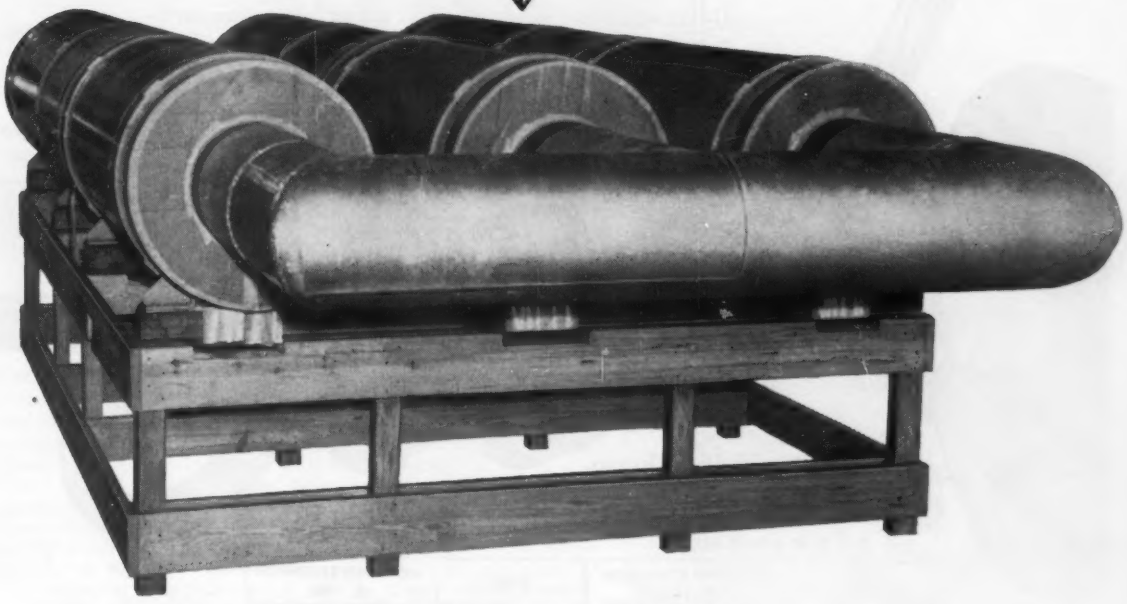
WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Atlanta	Chicago	Denver	Indianapolis	Minneapolis	Philadelphia
Baltimore	Cincinnati	Detroit	Kansas City, Mo.	Newark	Pittsburgh
Boston	Cleveland	Grand Rapids	Los Angeles	New Orleans	Providence
Charlotte	Dallas	Houston	Milwaukee	New York	Rochester
	St. Louis	San Francisco	Seattle	Waterbury	

First 10,000 amp **self-cooled** isolated phase bus ever built

I-T-E 10,000 amp self-cooled isolated phase bus in laboratory for thermal test.



. . . design eliminates auxiliary forced-air cooling equipment

Now you can get heavy current isolated phase bus of this rating and above without having to buy and maintain auxiliary equipment to cool it.

I-T-E design includes:

- All aluminum conductors
- Connectors—bolted or field welded
- Covers—telescoping type; split halves, bolted or field welded

For more complete information, write Switchgear Division, I-T-E Circuit Breaker Company, 19th and Hamilton Sts., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY • Switchgear Division

FOR DISTRIBUTION AND OTHER SHORT SPAN APPLICATIONS

NEW! HOLDS 4200 POUNDS ON 4/0 ACSR*

The Burndy dead-end clamp type CUW-A-E is made of high strength aluminum alloy with excellent weathering properties. Pulling eye is in line with the center of the cable to permit a straight pull. Single saddle under captured U-bolts distributes pressure over a long contact surface. Belled cable entrance prevents damage to cable strands. The cable may be cut off and dead-ended in the connector or carried through for jumper application.
Furnished with galvanized steel U-bolts and clevis pin.
Write for detailed data sheet.

*BURNDY Dead-End Clamp, Type CUW-A-E

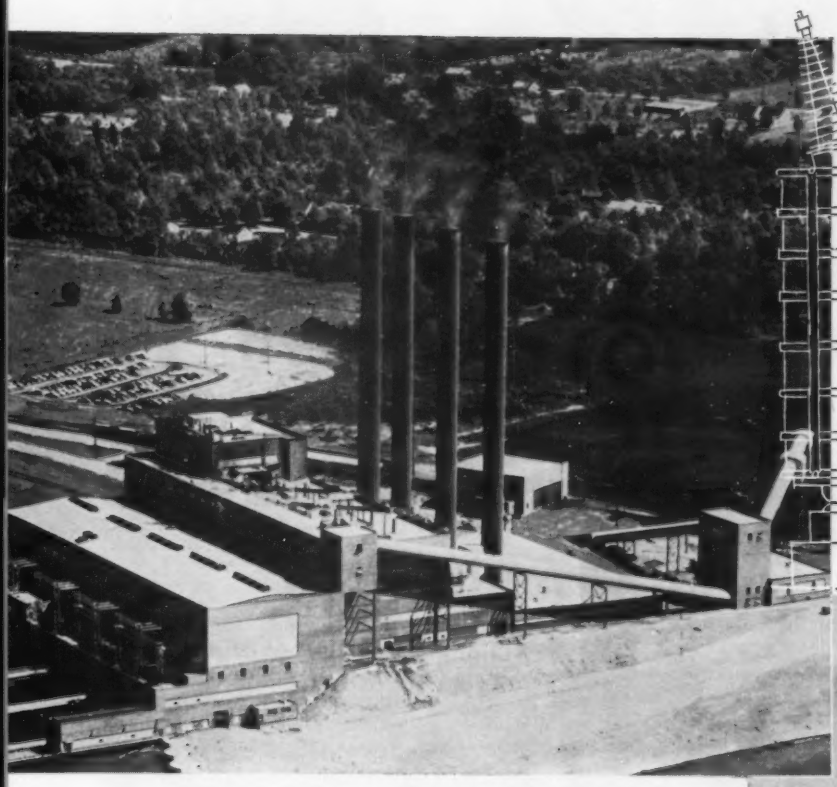
ALUMINUM		ACSR	
SIZE	HOLDING STRENGTH IN LBS.	SIZE	HOLDING STRENGTH IN LBS.
4/0	3,400	4/0 (6-1)	4,200
350 Mcm	5,000	336.4 Mcm (18-1)	5,500
500 Mcm	7,600	477 Mcm (18-1)	7,700
1000 Mcm	10,000	—	—

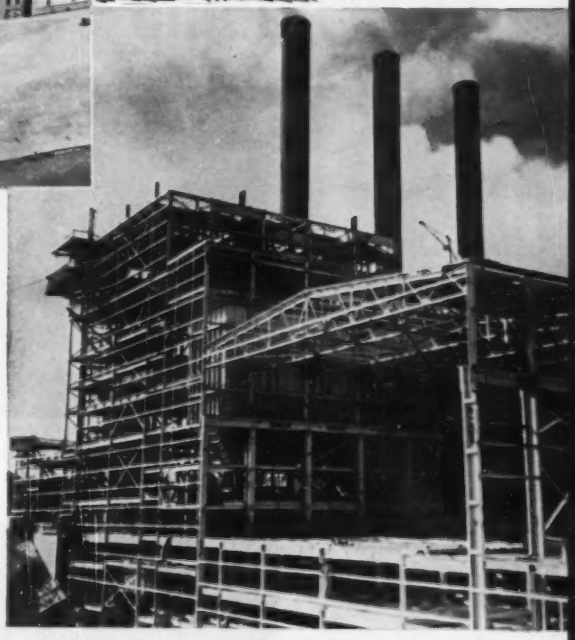
BURNDY

55-12

Norwalk, Connect. • Toronto, Canada • Factories: New York, California, Toronto • Export: Philips Export Company

MORE POWER
(HOUSES) TO YOU





The Phenomenal Growth of the utility field is vividly reflected in the vast number of new power houses which will more and more come to encompass nuclear power as well as electricity. Ingalls is the largest independent fabricator of structural steel in the country for power houses. So it is with pride we point to the "more and better" power houses of 1956.

Currently, Ingalls is working on fifteen jobs of this nature. A recently completed job for which Ingalls supplied the structural steel is the #4 unit of The Cleveland Electric Illuminating Company's Eastlake Power Plant shown here. When this 240,000-kilowatt giant goes into operation early this year, it, and the three 140,000-kilowatt turbogenerators now in service, will generate enough electricity to light nearly a million homes.

If you are contemplating a new power house, or an addition to your present power houses, Ingalls offers you its service—fabricated steel, steel erection, or both. Your inquiries are invited.

FABRICATING STEEL IS OUR BUSINESS

THE INGALLS **IRON WORKS COMPANY**
BIRMINGHAM, ALABAMA

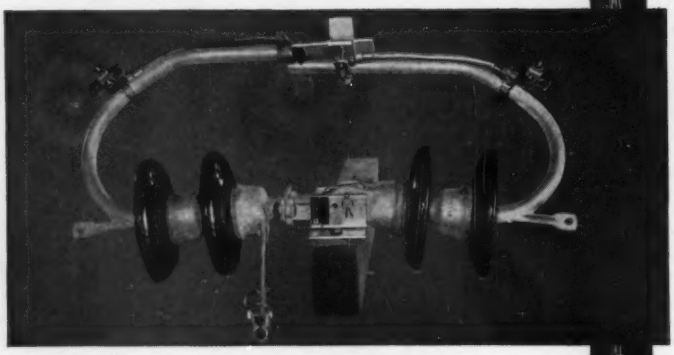
SALES OFFICES: New York, Chicago, Pittsburgh, Houston, Atlanta, New Orleans

PLANTS: Birmingham, Ala.; Verona, Pa.; Pascagoula, Miss.; North Birmingham, Ala., Decatur, Ala.

Compare pole top appearance!

KPF Switches

modern functional attractive



KPF Air Break Switches look different because they are different. Their pole top appearance is neat and uncluttered. There is a "straight-through" cleanliness of line—the visual appeal of design simplicity.

With this simplicity goes operating dependability and long life. There are no delicate mechanisms to malfunction, freeze, lock from cross-arm warping, need lubrication or wear out. This same simple construction also saves weight. KPF phase units weigh about the same as a comparable insulator stack. Double cross-arms and extra bracing are not needed. Installation is faster and less expensive.

KPF Switches have proved themselves in nearly a half century of major system operation. Why not get the details and make a test installation.

KPF
AIR BREAK SWITCHES
Standard for nearly half a century

For catalog and complete specifications, write direct

KPF ELECTRIC COMPANY
Dept. E. 1624 E. Alpine Avenue
Stockton 5, California

Transportation. The 4-Wheel-Drive 'Jeep' Truck's go-anywhere ability takes crews and equipment to meet service emergencies, over good roads or no roads, in good or bad weather—along the right-of-way or to off-road structures where other vehicles can't go.

Only 4-Wheel-Drive 'Jeep' Vehicles meet every service emergency!

Trenching. The 'Jeep'-propelled trencher digs up to 800 feet of clean-cut trench per hour, to speed the installation of cable, conduit and service lines. Travels safely on the highway at top legal speeds between jobs.

Maintenance. With the extra traction of its 4-wheel drive, the versatile Universal 'Jeep' gets through to trouble spots, on the road or off, with sure dependability. It helps speed installations, keeps service and maintenance schedules up-to-date.

Whether carrying an underground detail with cable splicing equipment or helping work crews string high wire, 'Jeep' vehicles work 'round-the-clock in electrical industry service.

Time-tested, performance-proved go-anywhere 'Jeep' transportation virtually assures uninterrupted customer service. In emergencies, the extra traction of 4-Wheel-Drive 'Jeep' Vehicles carries men, tools and equipment through mud, sand, soft earth or up steep grades—in heavy rain, snow or other emergencies of weather—to reach tower, substation, service lines or wherever repairs are needed. On the highway, 'Jeep' vehicles travel in conventional 2-wheel drive at top legal speeds.

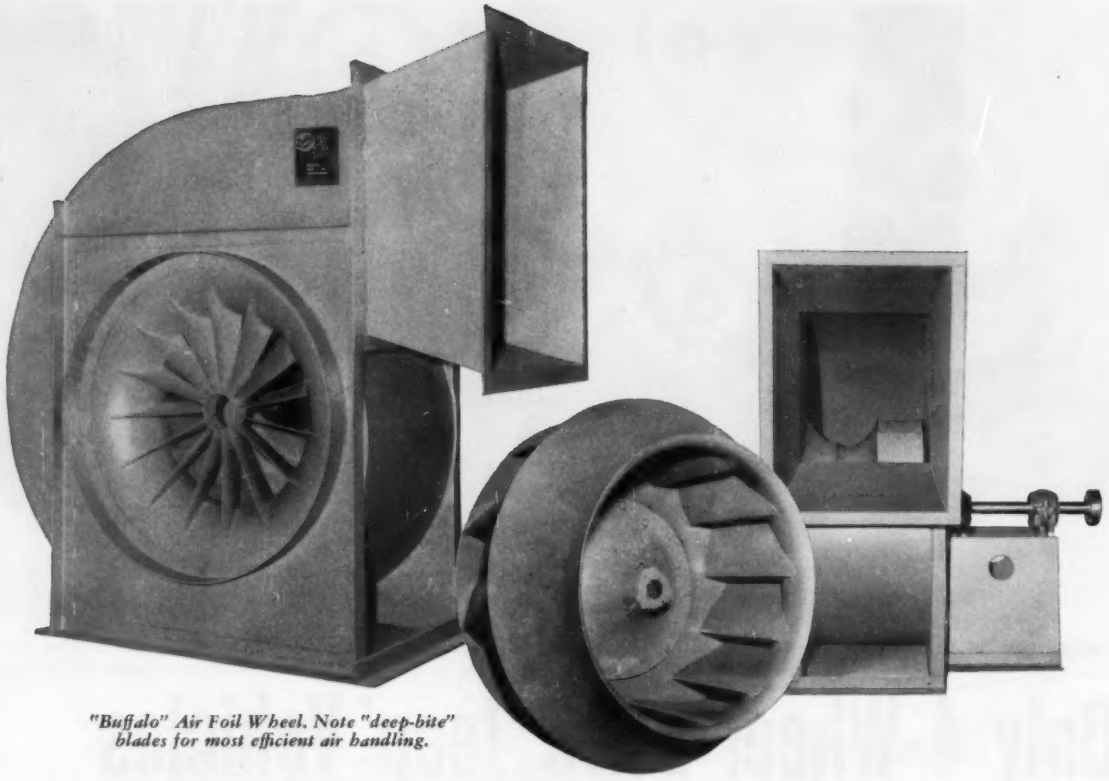
For hundreds of different jobs, from installing meters to patrolling the right-of-way, rugged 'Jeep' vehicles serve the electrical industry. Ask your Willys dealer for a practical on-the-job demonstration today, or write for information.

The 'Jeep'®

family of 4-Wheel-Drive Vehicles

WILLYS... makers of the world's most useful vehicles

WILLYS MOTORS, INC., TOLEDO 1, OHIO



"Buffalo" Air Foil Wheel. Note "deep-bite" blades for most efficient air handling.

New! "BUFFALO" "Deep Blade" AIR FOIL FANS
a new high in forced draft performance

MOST STREAMLINED INLET — note smooth inlet bell matching the deep drawn wheel flange to form a "true half circle" inlet into wheel.

DEEPER BLADES FOR DEEPER "BITE"—note exceptionally deep blade design in photo at top. This improves air flow thru blade channels. Flanged hubs — smoothly curved for best air entry conditions.

The wheel has been dynamically tested in the "Buffalo" Vacuum Pit — possible only at "Buffalo". By spinning various rotor designs to destruction the optimum wheel construction was determined — another "Buffalo" "Q" factor.*

IMPROVED FAN OUTLET — reduces outlet air turbulence from fan cutoff into duct by making more even, gradual change from velocity to static pressure. Without this complete streamlining of inlet, housing AND outlet, such high efficiency is impossible.

Smooth Divergent Flow

92% MECHANICAL EFFICIENCY — not an inflated claim, but proved performance you can expect in field operation.

WRITE FOR ALL ENGINEERING DATA AND RECOMMENDATIONS ON YOUR DRAFT PROBLEM

**The "Q" Factor — the built-in Quality which provides trouble-free satisfaction and long life.*

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

"Buffalo"

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING FORCED DRAFT COOLING HEATING PRESSURE BLOWING

Specify ANDERSON

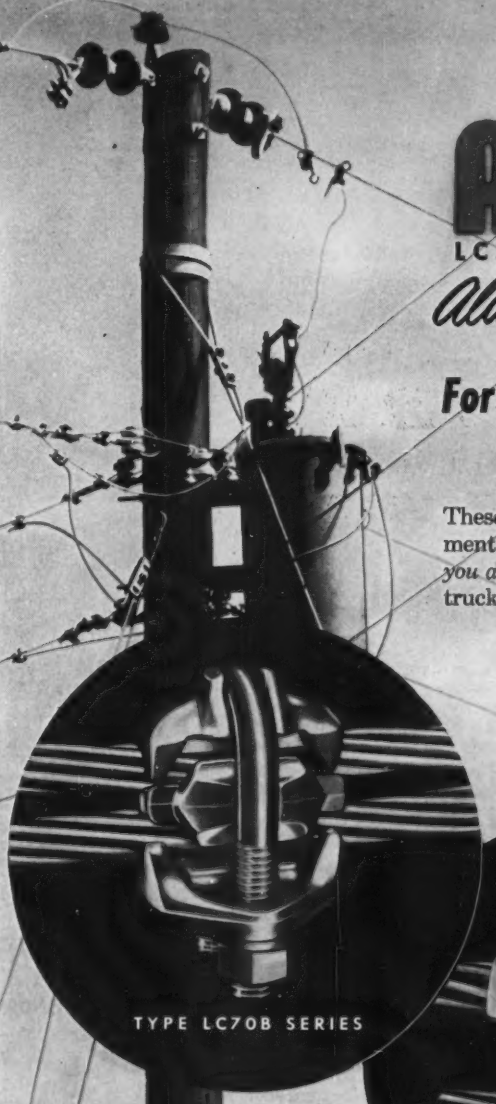
LC50 - LC500 - LC70B SERIES

Aluminum CONNECTORS

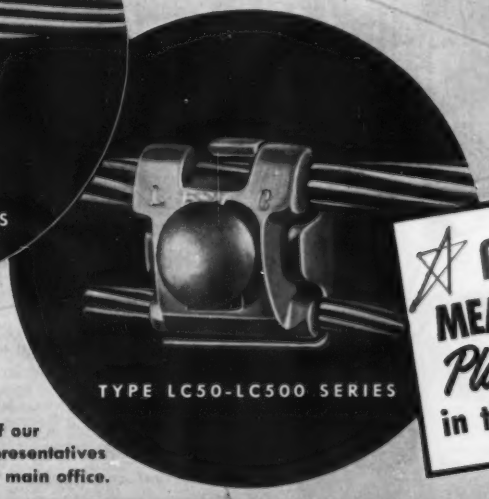
For WIDER APPLICATION on Aluminum Distribution Systems

These Anderson Connectors will eliminate the large assortment of types and sizes you are now using—*and still give you a wider range of application.* They save costs . . . reduce truck inventory . . . save time on the job.

CATALOG NO.	MAIN	TAP
LC-51A	No. 6—1/0 ACSR	No. 6—No. 2 ACSR
LC-52A	No. 6—1/0 ACSR	No. 6—1/0 ACSR
LC-511A	No. 6—1/0 ACSR	No. 8—No. 2 COPPER CABLE
LC-522A	No. 6—1/0 ACSR	No. 8—1/0 COPPER CABLE
LC-70B	No. 6—No. 2 ACSR	No. 6—No. 2 ACSR
LC-71B	No. 6—1/0 ACSR	No. 6—1/0 ACSR



TYPE LC70B SERIES



TYPE LC50-LC500 SERIES

☆ ABW DESIGN MEANS QUALITY *Plus* STRENGTH in the RIGHT PLACES!

Consult one of our nearest 20 representatives or contact our main office.

Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES for SUBSTATION • TRANSMISSION • DISTRIBUTION SYSTEMS *for over a Quarter Century*

ABW

ANDERSON BRASS WORKS, INC.

P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

HERE'S ANOTHER WAY...

Preformed Guy-Grips CUT GUYING COSTS!

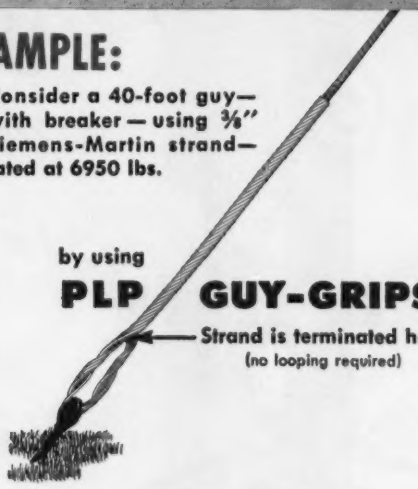
EXAMPLE:

Consider a 40-foot guy—with breaker—using ⅜" Siemens-Martin strand—rated at 6950 lbs.

by using

PLP GUY-GRIPS

Strand is terminated here
(no looping required)



1 Since PLP Guy-Grips eliminate looping, strand saving of 12 feet or more per guy results. **SAVING: $.67 per guy**

2 Substitute ¼" Extra High Strength Strand—rated 6650 lbs. PLP Guy-Grips make this possible since they hold the full rated strength of E.H.S. Strand. The following strand savings result (current cost of ⅜" galvanized strand is $2.24 per guy while ¼" E.H.S. costs $1.36 per guy)*: **SAVING: $.88 per guy**

TOTAL STRAND SAVING ALONE: $1.55 per guy

3 Preformed Guy-Grips cost only $.55 each for ¼" E.H.S. Strand size. (PLP Cat. No. 25 GDE-¼")

Compare this cost with your current fitting.

PLUS LABOR SAVINGS

In every Preformed Guy-Grip installation, you hold the full strength of the strand.

☑ CHECK THESE ADDITIONAL SAVINGS:

- ✓ With PLP Guy-Grips, leading utilities estimate installation savings upward of 50%.
- ✓ Save an additional 10% by using 3-wire strand instead of 7-wire. PLP Guy-Grips will hold 3-wire strand equally well.
- ✓ Save space and inventory costs by standardizing on PLP Guy-Grips and lighter E.H.S. Strands. One size strand can be substituted for several sizes and grades previously used.

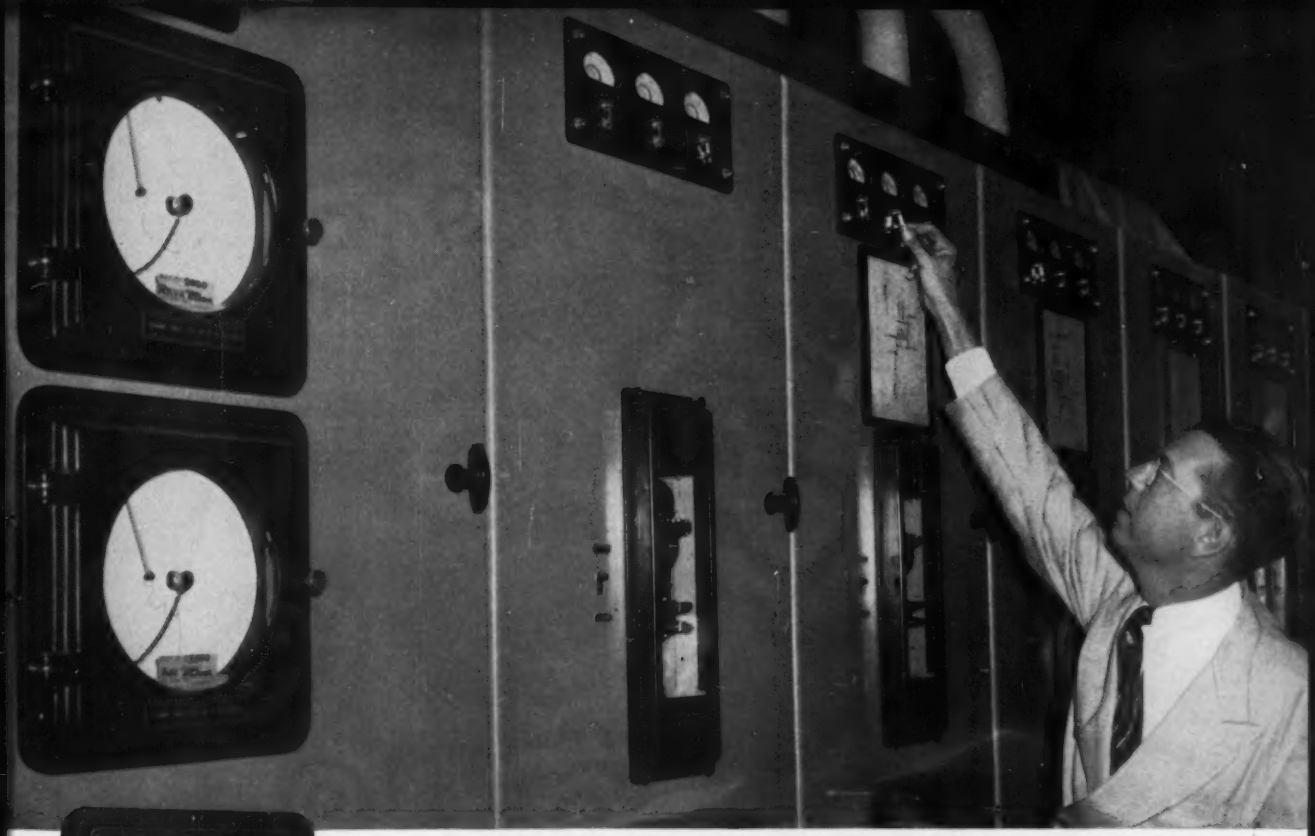
PLP GUY-GRIPS ARE ALSO AVAILABLE IN COPPER-WELD, BRONZE, AND STAINLESS STEEL.

***Based on current strand prices—75,000 feet to carload lots.*

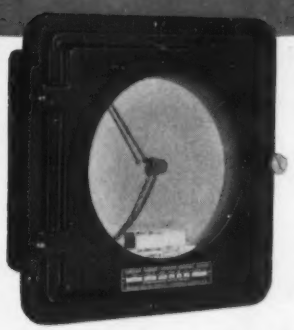
PLP GUY-GRIPS DON'T SLIP . . . even under impact!

Made in accordance with or for use under one or more of the following U.S. Patents: 2,275,619; 2,587,521; 2,650,413; 2,651,865; other patents pending.

PREFORMED LINE PRODUCTS COMPANY
5349 ST. CLAIR AVENUE • CLEVELAND 3, OHIO



These Lincoln Semiflush Switchboard Graphics measure substation total load, both KW and KVA. Note individual circuit measurement with Lincoln Triplex Ampere Demand Meters at top of switchboard.

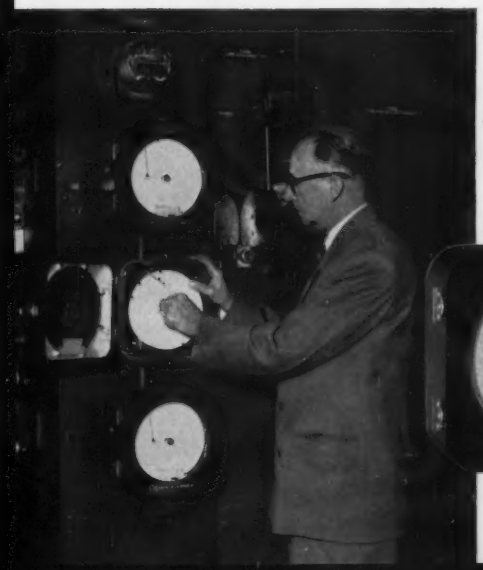


Put Substation Operating Data on Record with LINCOLN GRAPHIC METERS

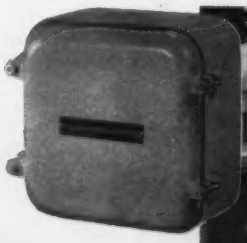
When knowledge of time and duration of loading conditions is required for system betterment—Lincoln Graphic Meters offer a simplified low-cost means of system measurement. Lincoln Graphics are thermally lagged to integrate minor fluctuations into a clearly defined line, making legible records possible on single charts up to 32 days.

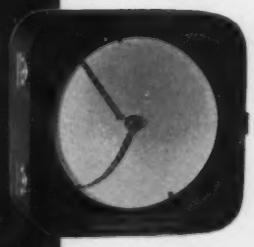
Write today for full information on Lincoln Graphic Meters and Simplified Measurement for System Operation.

SANGAMO ELECTRIC COMPANY • Springfield, Illinois

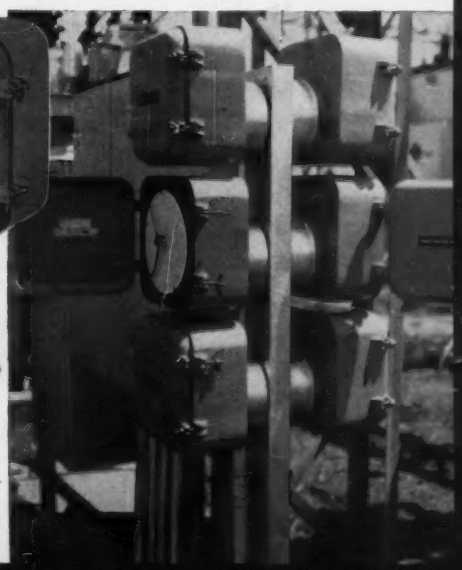


Three surface-mounted Lincoln Type CCA Graphics measure main station bus current on 8 day charts.





Reactive and Kilowatt Lincoln Demand Graphics in paired sockets correlate feeder KW and RVA in an outdoor substation. These socket type graphics are merely "plugged in". The socket makes the correct connection for each meter.



SM56-2

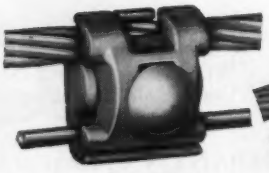
Reduce Inventory!

USE BLACKBURN'S PermaCad Aluminum Fittings

CHECK THESE PLUS FEATURES

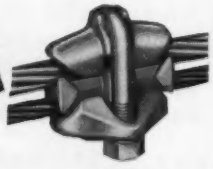
- All fittings may be used on either aluminum or copper conductors. Each fitting accommodates a wide range of wire sizes—few fittings are needed in stock or on trucks.
- Installation errors are eliminated on bi-metallic connections. Either groove will accommodate aluminum or copper conductors.
- Permacad fittings are available in one or two bolt parallel groove clamps—single and double U-bolt clamps. There's a fitting for every job.
- Grooves are contoured to surround conductor and provide large contact areas . . . improving conductivity.
- Non-copper-bearing, heat treated aluminum alloys used in all castings. Hardware available in either hot dipped galvanized steel or high strength aluminum alloy. Bolts alumilited to prevent seizing.

* **PERMACAD** *is a complex, heavy duty plating of cadmium and other metals which has exceptionally long life. PERMACAD protects aluminum because of its favorable electrogalvanic potential and is highly resistant to galvanic corrosion when in contact with copper.*

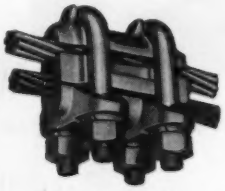


PGP SERIES
One bolt parallel groove clamp. Three fittings accommodate wire ranges from 8 AWG to 397.5 MCM.

PGP 400 SERIES
Two bolt parallel groove clamp. One clamp accommodates conductors from 1 str to 400 MCM.



DLC GP SERIES
Single U-bolt clamp. Four clamps accommodate wire range from 6 AWG to 266.8 MCM.



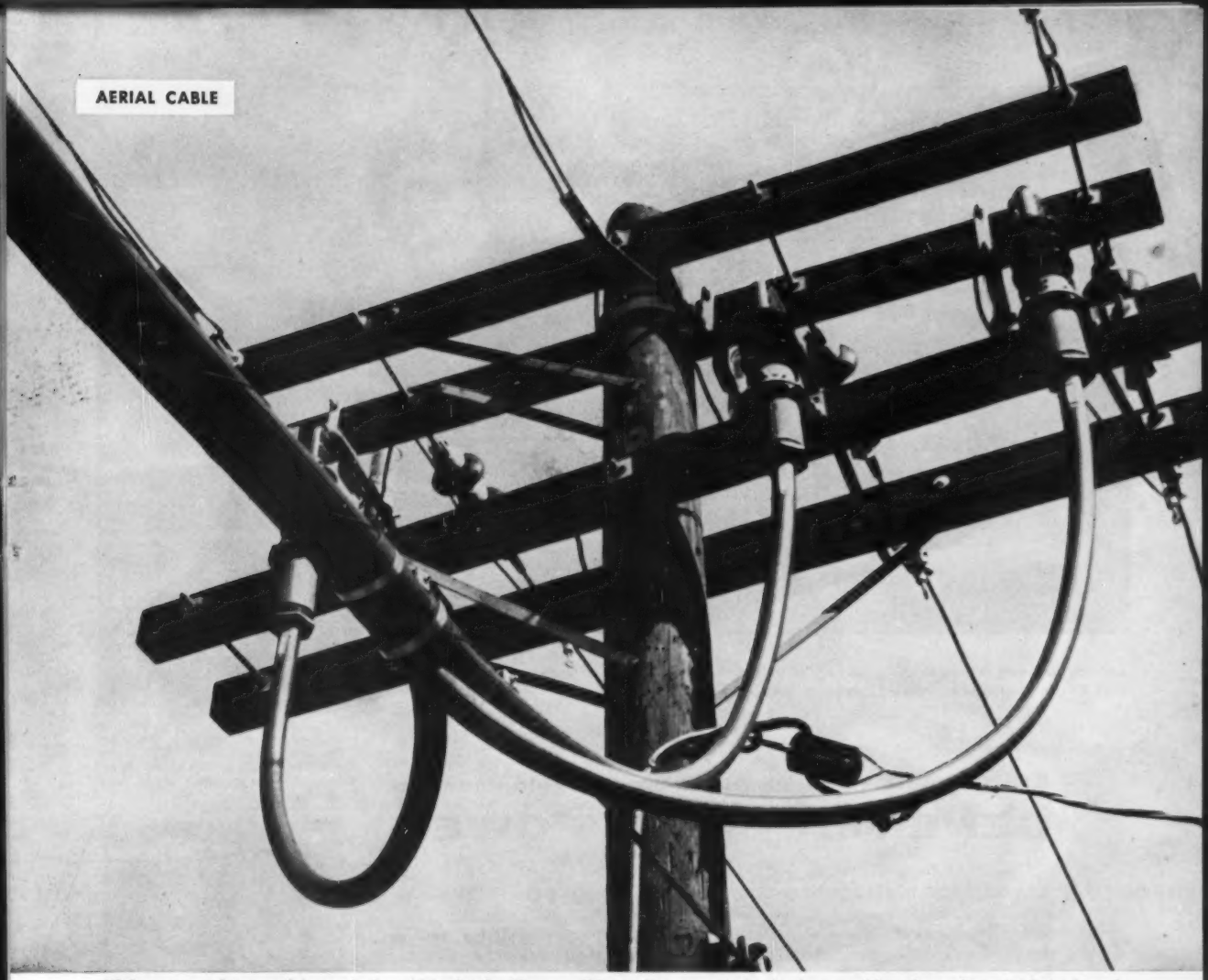
2U GP SERIES
Double U-bolt clamp. Six clamps accommodate conductors from 1 str to 397.5 MCM.

BLACKBURN PermaCad FITTINGS

IMPORTANT: We recommend the use of CONTAX on all aluminum and bi-metallic connections. CONTAX is an oxide inhibiting compound with an ASTM drop point in excess of 500° F.

AVAILABLE THROUGH ELECTRICAL DISTRIBUTORS EVERYWHERE

JASPER BLACKBURN CORPORATION
35 MADISON ST. • ST. LOUIS 6, MO. • PHONE MAIN 1-2821



High-ozone resistance of Anaconda Type AB-insulated cable pays off here where ozone-cutting is often a problem when ordinary insulation is used.

New aerial cable gives ozone the air

New Anaconda Type AB-insulated cable has *highest* resistance to ozone.

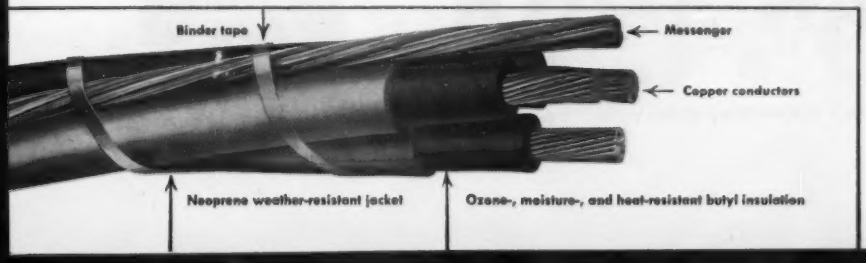
Ozone-cutting – No. 1 enemy of high-voltage insulation – can be arrested.

ANACONDA Type AB butyl insulation on aerial and other high-voltage cable ends this problem.

Type AB is *inherently* resistant to ozone. Moreover, this high resistance to ozone has enabled Anaconda engineers to concentrate on other properties – to develop Type AB's other electrical and physical properties to the very peak of performance.

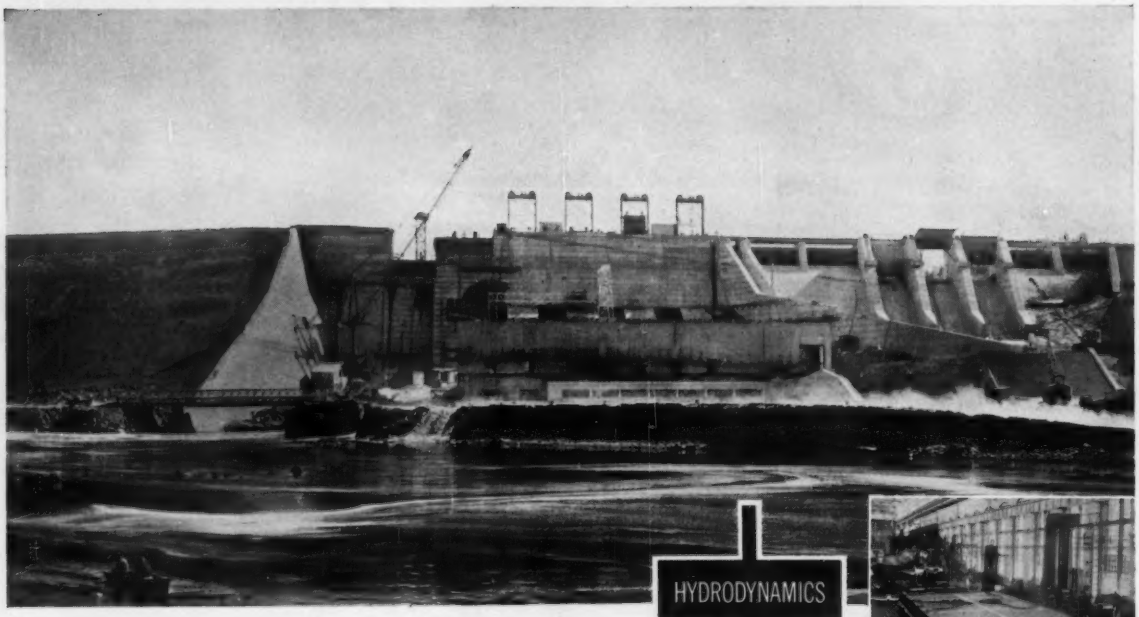
Proof is in a series of tests – made over a period of years by Anaconda engineers. These tests – covering ozone, temperature, moisture absorption, dielectric strength, ionization level, aging, and other properties – show clearly the superiority of ANACONDA Type AB butyl insulation.

Put your cable problems up to the Man from Anaconda. Anaconda Wire & Cable Co., 25 Broadway, New York 4, N. Y.

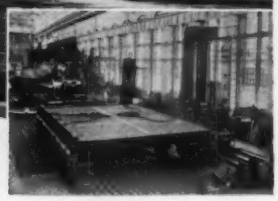


ANACONDA®

AERIAL CABLE



Looking upstream across the tailrace area, the SMS-Fixed Wheel Intake Gate on Unit #3 can be seen being lowered into position atop the dam.



Two halves of a gate have been assembled and aligned on a 7-inch bar horizontal boring mill. SMS bores wheel axle holes in this manner to assure accurate alignment within close tolerances.

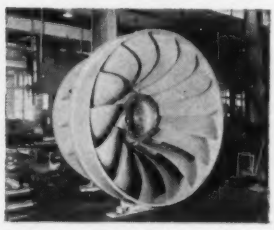
SMS-Francis Turbines At Littleton Development To

GENERATE PEAK POWER

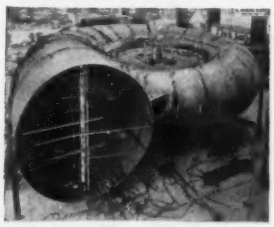
To meet rapidly increasing demands within the New England Electric System's area, Moore Station near Littleton, New Hampshire, will soon go on the line delivering peak load power. Rated at 150,000 kw, this new hydro plant is the third and last on the Fifteen Mile Falls stretch of the Connecticut River. Including the Comerford and McIndoes Stations immediately downstream, this will give a total capacity of 310,000 kw in a river fall of 367 feet at this location. Thus the largest of New England's rivers becomes one of the most highly developed streams of its size.

All three of the Fifteen Mile Falls plants are powered by SMS turbines. The four Littleton units are the vertical Francis type, each rated at 56,400 HP under a 150-foot head. SMS also provided four 18-foot x 24-foot fixed wheel intake gates for operation with an 84-foot head on the sill of the gate frame. The gates are designed for closing under full discharge and opening under balanced hydraulic conditions.

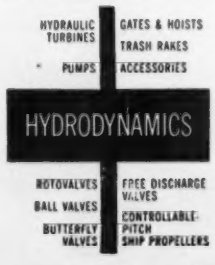
These three plants, with both SMS-Francis and Kaplan turbines as well as accessories, illustrate S. Morgan Smith's ability to handle the needs of any hydro project. Over three quarters of a century's experience in hydraulic design and manufacture stand behind SMS equipment. For full information, write S. Morgan Smith Company, York, Pennsylvania.



Unit #3's runner, completed and ready for shipment.



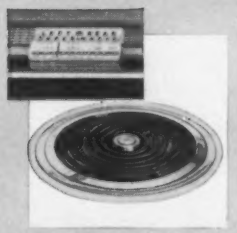
The 198-inch diameter riveted plate steel spiral case (with riveted cover plates) for Unit #1, taken during assembly at SMS Plant #2.



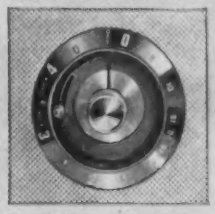
S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

Super-Matic



AUTOMATIC SURFACE UNIT . . . fry, boil, saute, pan broil and grill with thermostatically controlled, balanced heat at all times.



AUTOMATIC MEALTIMER . . . Select desired Super-Matic heat and set MEALTIMER for time food should cook—on surface or in deep well. Food cooks at the proper heat for the proper time, then it shuts itself off . . . automatically!

AUTOMATIC FRENCH FRYER, DEEP-WELL COOKER . . . makes soups, stews, economy meals—even bakes under controlled heat.

AUTOMATIC CUSTOM COOKER-SERVER . . . it's a frying pan, a grill, a waterless cooker, even a Dutch Oven. Precision timed and heat controlled by the Super-Matic Calrod® Unit and Mealtimer.

Again,

Hotpoint

Hotpoint

ELECTRIC RANGES

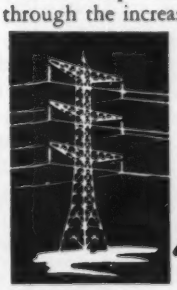
—Building Increased Utility Revenue With Advanced Automatic Electric Cooking!

SUPER-MATIC COOKS ALL WAYS...AUTOMATICALLY!

Hotpoint Electric Ranges cook everything in the book—*automatically!* With a range line already loaded with super-cooking features, now they can fry . . . bake . . . broil . . . simmer . . . stew . . . deep-fry . . . grill . . . *all automatically* with Hotpoint's new SUPER-MATIC!

Hotpoint's Super-Matic offers the homemaker undreamed of convenience . . . unmatched freedom from time-consuming cooking chores . . . *plus* faster, more precise cooking.

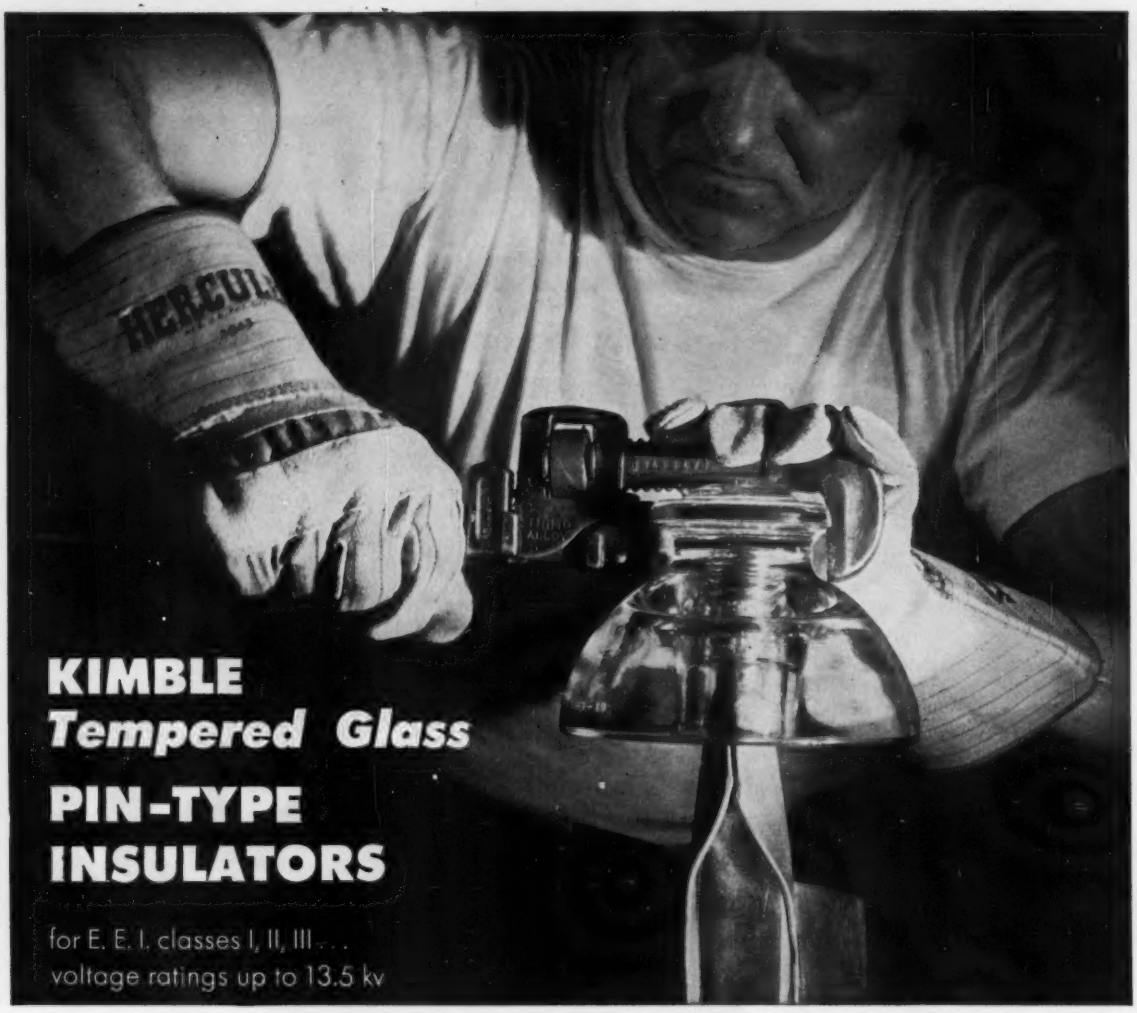
And Hotpoint's Super-Matic offers utilities expanded revenue through the increased demand Super-Matic is building for automatic electric ranges.



Have your Hotpoint Distributor Show You The Complete NEW Hotpoint Range Line for '56 . . . Six New 39" Models . . . Two New 30" Models . . . And Five Beautiful Hotpoint Colortones, As Well As Classic White.

looks at Tomorrow, Today!

HOTPOINT Co. (A Division of General Electric Company) **5600 West Taylor Street, Chicago 44, Illinois**



Stronger than the pin that supports it

SO STRONG . . . Torque test shows strength sufficient to strip threads on lead bushed pins and actually twist pole top steel pins.

This great strength saves installation time. It is not necessary to loosen Kimble tempered insulators for line-up with the conductor. Their strength will always allow another quarter-turn.

If it's on the pin, it's in service

In the event of shattering due to severe mechanical shock, insulator disintegrates into many small, non-sharp fragments. Trouble shooters can locate broken insulators—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how tempered glass can cut your line maintenance costs. Write for descriptive folder that gives complete details. Address: Kimble Glass Company, subsidiary of Owens-Illinois, Dept. EW-2, Box 1035, Toledo 1, Ohio.

KIMBLE INSULATORS
AN (O) PRODUCT

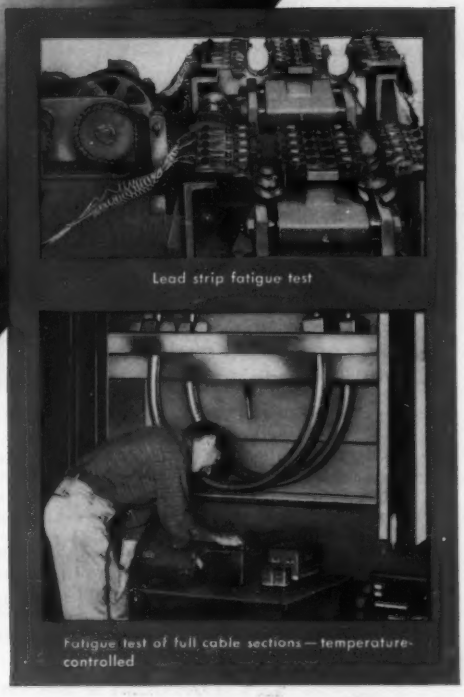
OWENS-ILLINOIS
GENERAL OFFICES • TOLEDO 1, OHIO

ROEBLING PAPER POWER CABLE WITH TELLURIUM LEAD ALLOY SHEATH

TELLURIUM LEAD ALLOY SHEATHS MEET ALL REQUIREMENTS FOR FATIGUE RESISTANCE

TODAY'S HIGHER TEMPERATURES and increased loads are power cable problems met most satisfactorily and economically by Roebling Tellurium Lead Alloy Sheath. This sheath has absolutely top fatigue resistance; gives vastly increased service life despite severe bending stresses and cable movement during load cycles. Furthermore, Roebling Tellurium Lead Alloy has outstanding stability under heat—high temperature incurred at joints, terminations and in duct splicing cause no grain growth or physical impairment.

Roebling is unmatched in the breadth of its experience with Tellurium Lead Alloy Sheath and in the volume of cable it has produced with this remarkable sheathing. We will welcome the opportunity to send you Bulletin 205-B containing technical data on Roebling Tellurium Alloy Sheaths.



Lead strip fatigue test

Fatigue test of full cable sections—temperature-controlled

ROEBLING

Subsidiary of The Colorado Fuel and Iron Corporation

JOHN A. ROEBLING'S SONS CORPORATION, TRENTON 2, N. J. BRANCHES: ATLANTA, 934 AVON AVE. • BOSTON, 11-15 STILLING ST. • CHICAGO, 5525 W. ROOSEVELT RD. • CINCINNATI, 3253 FREDONIA AVE. • CLEVELAND, 13235 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST. • DETROIT, 915 FISHER BLDG. • HOUSTON, 6216 NAVIGATION BLVD. • LOS ANGELES, 5340 E. HARBOR ST. • NEW YORK, 19 RECTOR ST. • ODESSA, TEXAS, 1920 E. 2ND ST. • PHILADELPHIA, 330 VINE ST. • PITTSBURGH, 1723 HENRY W. OLIVER BLDG. • SAN FRANCISCO, 1740 17TH ST. • SEATTLE, 900 1ST AVE. S. • TULSA, 321 N. CHEYENNE ST. • EXPORT SALES OFFICE, 19 RECTOR ST., NEW YORK 6, N. Y.

ALLIS-CHALMERS

NETWORK TRANSFORMERS

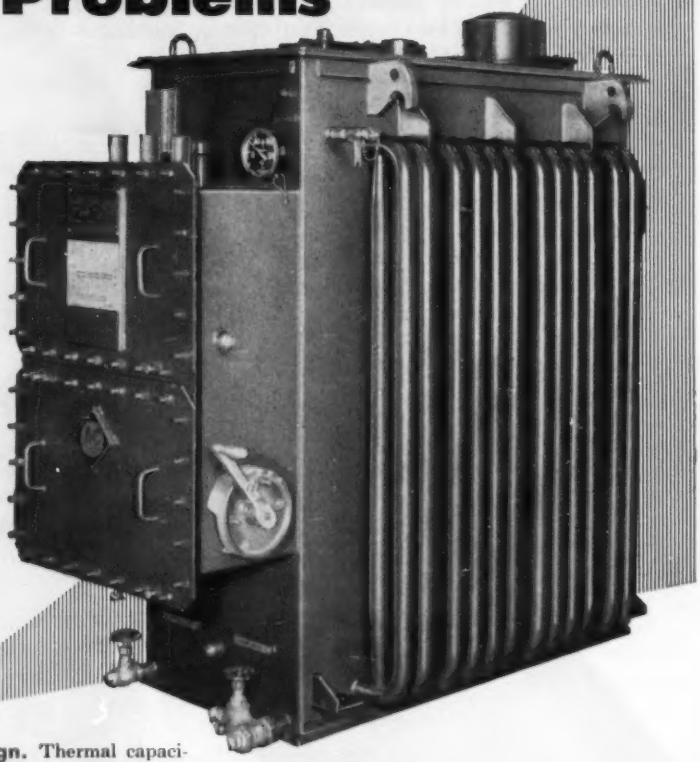
Space-Saving Solution To Network Problems

COMPACT design means savings in high-cost space when you use Allis-Chalmers network transformers. Utilities all over the country are choosing Allis-Chalmers as increasing loads put more demands on their downtown network systems. New Allis-Chalmers units are ordered repeatedly to take their place alongside the more than 1½ million kva already installed.

You get unusual flexibility in choice. To simplify application problems, Allis-Chalmers builds all three types: oil-filled, *Chlorextol* liquid-filled, and sealed dry-type.

Investigate all the advantages of compact, reliable Allis-Chalmers network transformer design. Consult your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-4781

Chlorextol is an Allis-Chalmers trademark.



Compact, low-loss design. Thermal capacities are high for severe load conditions. Sturdy, time-proved core and coil construction withstands repeated short-circuit stresses of network operation.

Safe, dependable tap-changing mechanism. Handle inserted through two-inch opening on cover operates mechanism. Handle cannot be removed unless it is in positive tap position. Cover location of handle entrance eliminates packing gland maintenance.

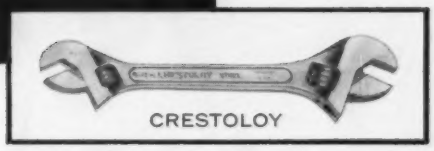
Threaded valve connections to tank are solder-wiped for extra protection. Valves are located for easy access. Globe-type valves with nonrotating seats close tight, avoid wear on valve seats.

Spiral-wound gaskets have proved their superiority over other types of gaskets for sealing bushings in the tank wall in over 7 years' continual use. Alternate plies of preformed spring-like metal and nonmetallic fillers provide unusual resilience and actually adjust themselves to changes in operating conditions. Gaskets can be installed without cements or grease. They can be quickly removed if required and may be re-used.

Shot blast cleaning, three coats of baked-on paint formulated for high water resistance, and protective compound treatment of base and tubes in base area give superior surface treatment.

A-C ALLIS-CHALMERS

ALLIS-CHALMERS



CRESCENT AND CRESTOLOY

outsell all other ADJUSTABLE WRENCHES

CRESTOLOY Wrenches are forged from a special alloy steel permitting thinner, trimmer design with greater strength and less weight than conventional types. They are available in Single End patterns, 4″ to 24″ size. Double-end in four models combining 4-6; 6-8; 8-10; 10-12 inch sizes. The 15″, 18″ and 24″ sizes, available in Single End pattern only, are distinguished by their tapered handles. There is no stronger or finer Adjustable Wrench than CRESTOLOY.

CRESCENT Wrenches are forged from selected carbon steel and specially heat-treated to increase their toughness and durability. Due to their lesser cost and relatively great strength, they are widely used in industrial and service operations where thinness is not essential. Available in Single End Patterns, 4″ to 18″.

Both CRESCENT and CRESTOLOY Wrenches represent the best in design and workmanship, and carry the same guarantee.

CRESCENT and CRESTOLOY TOOLS are sold by hardware dealers and industrial distributors everywhere. Look for the bright yellow Crescent Display panels and select from one of the world's greatest assortments of quality hand tools.

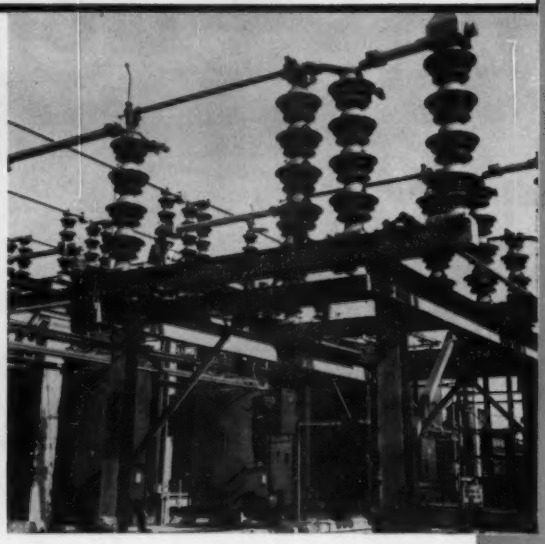
Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

FROM SEATTLE TO NEW YORK IT'S THE TYPE wag SWITCH!

Southern States' switches being specified by more and more utilities

SEATTLE—City of Seattle, Department of Lighting, uses 44 Type WAG Switches with AMPLITACT® in its new Duwamish Substation, seen here, and 12 in its Shoreline Substation.



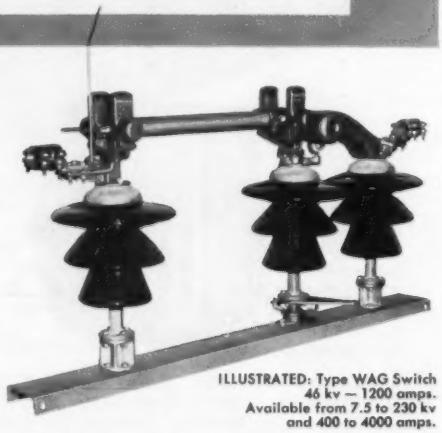
NEW YORK—Consolidated Edison Company's Astoria Generating Station uses Southern States 161 kv 1200 amp Type WAG Air Break Switches and G-WAG Grounding Switches.

Here is why growing numbers of Southern States' Type WAG Switches are being used throughout the nation:

Increasing generating capacities, with higher degrees of integration and corresponding increases in short circuit capacities, require switches that will meet these conditions.

The Type WAG carries full-rated continuous current indefinitely and withstands maximum short circuits. Even under the most adverse conditions, including icing, self-cleaning, high-pressure line contacts with greater deflection, shuntless design, and simplified mechanical linkage assure adequate performance.

All of the features are described in Bulletin 390-R. Get a copy from your Southern States representative, or write direct, and see why it will pay you to specify and use Type WAG Switches.



ILLUSTRATED: Type WAG Switch 46 kv — 1200 amps. Available from 7.5 to 230 kv and 400 to 4000 amps.

SS®

SOUTHERN STATES EQUIPMENT CORP.

HAMPTON, GEORGIA

IN CANADA: Dominion Cutout Co., Ltd., Toronto

Anaconda power control cable installed on vital automatic equipment at western dam.

The cables that help keep automation automatic

Where you have automation, remote, supervisory or other types of control, failure of just one wire could be costly – in down-time, upset schedules, damaged equipment. That's why so many automatically say Anaconda for control cable.

You too will rest easier knowing *your* cable is made by people with years of experience in producing the most complex of power cables. At Anaconda, quality control procedures are rigidly adhered to, and research works constantly for better performance.

A big family of Anaconda control cables offers you the *right* cable for every job:

1. *Rubber insulation, neoprene-covered, neoprene jacket over-all*
2. *Rubber insulation, braid-covered, neoprene jacket over-all*
3. *Polyethylene insulation, polyvinyl chloride jacket*
4. *PVC insulation, and polyvinyl chloride jacket*
5. *Polyethylene insulation, nylon-covered, polyvinyl chloride jacket over-all*

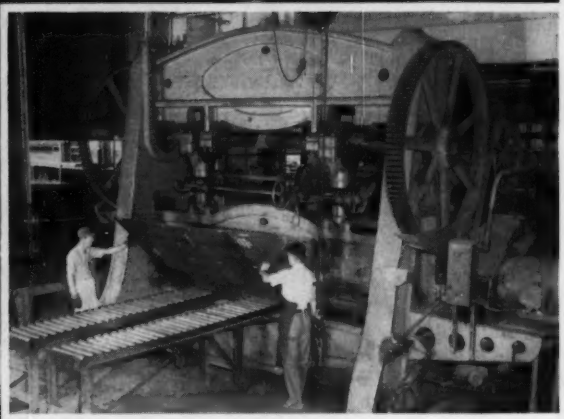
Conductors with printed coding are available – speed work, assure accuracy, and are permanently marked. See the Man from Anaconda or your nearest Anaconda distributor for full information and special application engineering aid. Or write about your cable requirements to: Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

55282

SEE THE MAN FROM ANACONDA®

FOR YOUR CONTROL CABLE

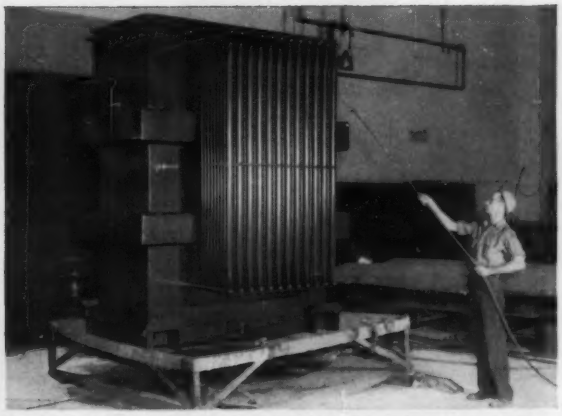
Wagner®
TRANSFORMERS
... the choice of leaders in industry



Sheet steel for Wagner transformer tanks is sheared to size, then bent and shaped on large brake presses, powerful enough to handle the heaviest steel plate.

This giant submerged arc automatic welding gantry designed and built under the direction of Wagner's engineers assures strong, uniform, leak-proof welds for longer-lasting transformers. It is capable of welding transformer tanks 20 feet long, 20 feet wide and 16 feet high. Controlled from one central station by a single operator, it can make smooth, continuous welds 17 feet long.

The worker in the "Man-from-Mars" costume is a sandblaster. After welding, the completed tank is carefully tested for leaks and then sandblasted to remove all rust, dirt and scale.



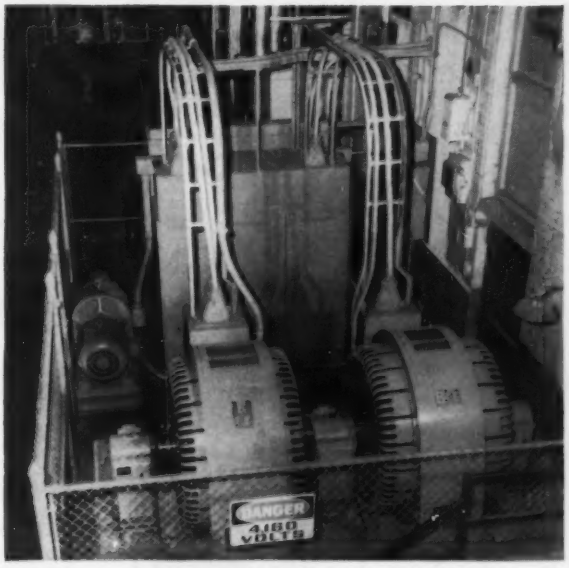
All tanks receive three coats of special paint applied by the flow painting process for long-lasting protection on all surfaces. Each coat is thoroughly dried and hardened in a baking oven.

Here's why the Wagner power transformers you buy give longer service life

Come inside Wagner's transformer plants. Here you'll find the most modern transformer production facilities manned by skilled technicians and all of it backed by Wagner's better-than-sixty-years of transformer building experience...

Wagner's insistence on the use of only the highest quality materials — carefully controlled production methods — rigid inspections and tests — all combine to assure you of power transformers that will provide the utmost in reliability and service continuity.

It will pay you to consult Wagner on your next power transformer installation. The Wagner Electric Corporation maintains thirty-two branch offices, located in principal cities, for quick convenient engineering service and consultation.



A 300 cycle generator for performing NEMA Standard induced voltage tests of turn-to-turn and major insulation. This is one of many tests made to insure that Wagner transformers meet all standards.

Wagner Electric Corporation
EST. 1891

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

T56-2

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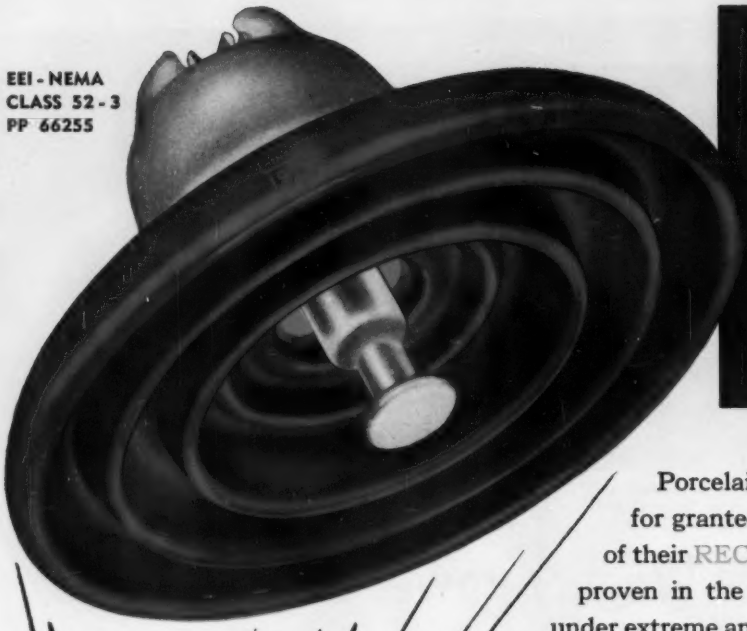


RR

Porcelain Products insulators are taken for granted — taken for granted because of their RECOGNIZED RELIABILITY — proven in the field for more than 63 years, under extreme and exacting conditions. RECOGNIZED RELIABILITY is acknowledged by the continued widespread and increasing use of Porcelain Products Insulators — a product has to be good to achieve this distinction.

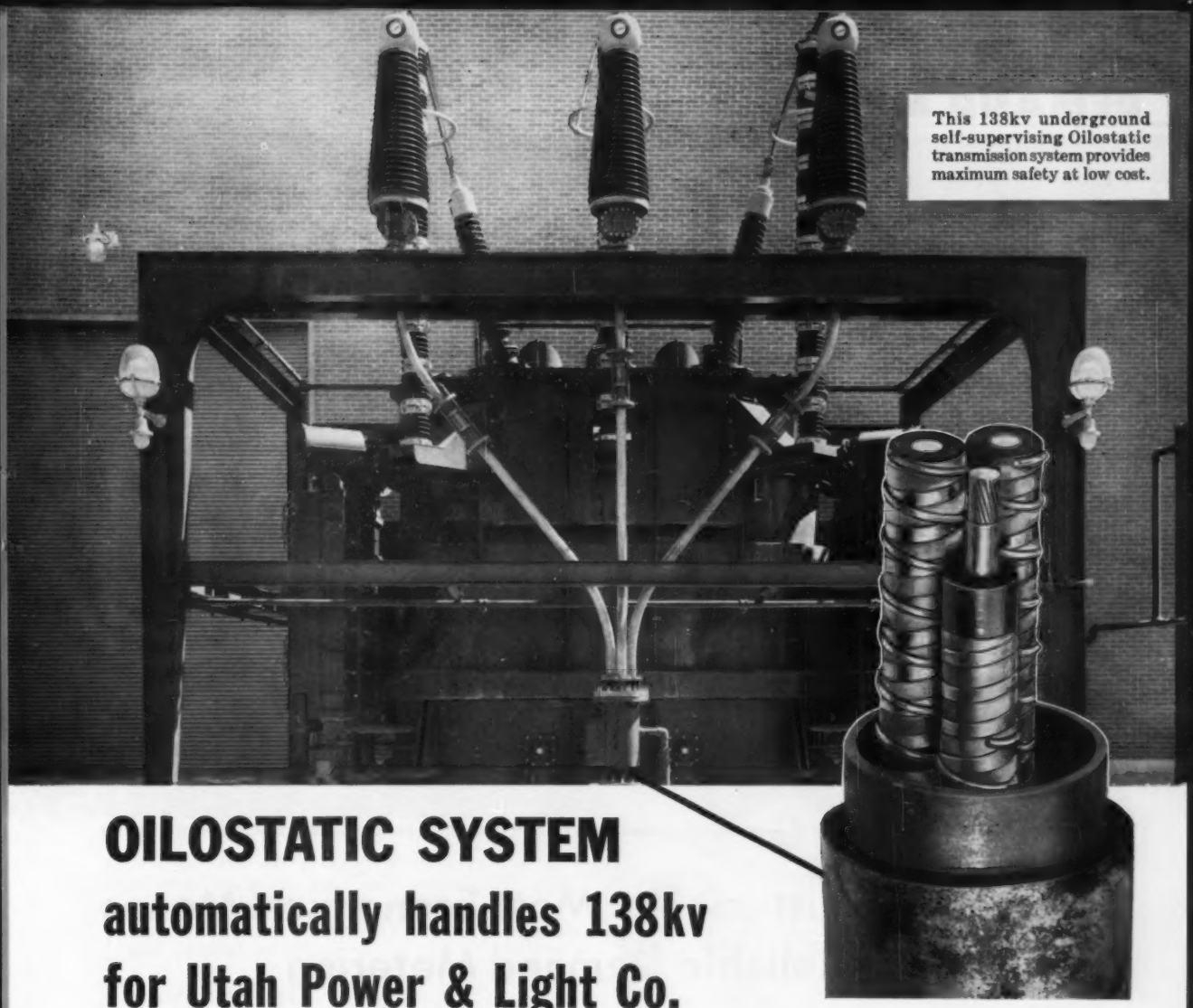
The New York Thruway, a real super, was built through the heart of the ROCKLAND LIGHT & POWER and the ORANGE & ROCKLAND ELECTRIC COMPANY power systems in the vicinity of Nyack, N. Y., precipitating major expansion and relocation problems of their power systems.

The Nyack area, now but 20 minutes from downtown N. Y. is realizing a tremendous program of industrial and residential development—placing enormous new demands on the power systems. Thousands of Porcelain Products Insulators are being used on this transmission expansion and relocation project—used because of their RECOGNIZED RELIABILITY.

PP INC.

Porcelain Products, Inc.

High Voltage Division
Parkersburg, W. Va.



This 138kv underground self-supervising Oilostatic transmission system provides maximum safety at low cost.

OILOSTATIC SYSTEM automatically handles 138kv for Utah Power & Light Co.

Recently the **Utah Power & Light Co.** started operation of the third section of its new Gadsby steam-electric station to supply the growing power demands of the Intermountain West.

For the all-important high voltage transformer leads, an underground Okonite Oilostatic system was selected and installed by the **Bechtel Corporation.**

This system consists of paper-insulated cables installed in a welded steel pipe filled with oil maintained at 200 psi. The advantages of this type system are:

1. *Proved reliability, ruggedness and stability.*
2. *High normal and overload current carrying capacity.*
3. *Low initial cost compared to duct systems, plus space savings.*
4. *Low maintenance cost through self-supervision.*
5. *Ideal for high voltage transmission in congested areas.*
6. *Provides maximum safety.*

Proof that **Utah Power & Light** can expect to get outstanding performance from this installation is the fact that Okonite Oilostatic systems have been in successful operation since 1932.

For information on Oilostatic which has been installed to handle potentials as high as 230kv, write for Bulletin EW-1044. Address:
The Okonite Company, Passaic, New Jersey.

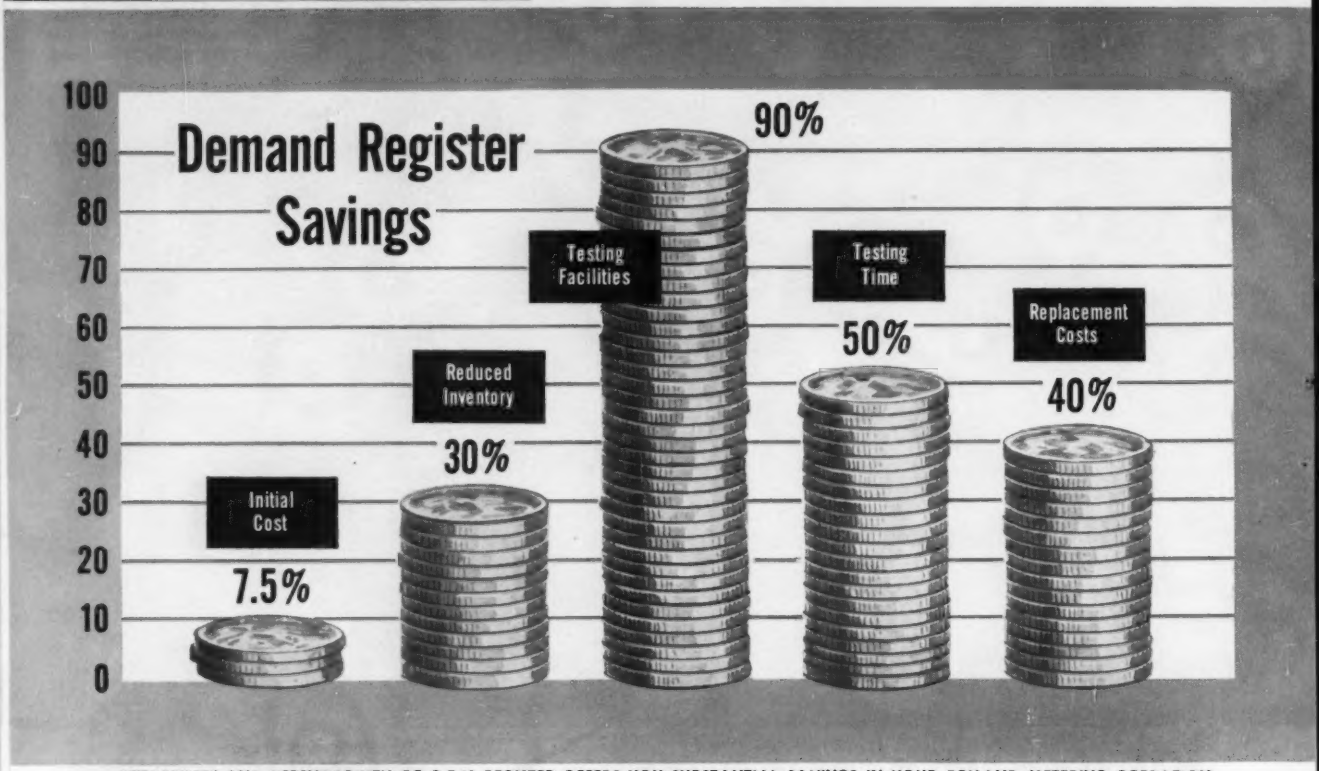
3133

available with either copper or aluminum conductors

OKONITE insulated cables

ADVERTISEMENT

DEMAND METERING



VERSATILITY AND DEPENDABILITY OF G.E.'S REGISTER OFFERS YOU SUBSTANTIAL SAVINGS IN YOUR DEMAND METERING OPERATION

Demand Registers: The Most Economical Means to Reliable Demand Metering

- Versatility of demand register offers reduced inventory costs
- On the line testing and maintenance assure lower operating costs
- Accuracy of register is unchanged during life

The many cost-saving features of General Electric's demand register offer you assurance of reduced metering costs. The flexibility of the demand register makes possible a 30% savings in reduced inventory, while the interchangeability of the register provides a 40% savings in replacement costs.

These savings plus the dependable, accurate operation of G.E.'s mechanical demand registers have led to its increasing acceptance by the utility industry. Since 1952, this acceptance has been marked by an increase of 70% annual sales of demand registers, as compared to but a 29% increase in the total demand meter market.

REGISTER FLEXIBILITY . . . The versatility of design of General Electric's demand register offers the opportunity of converting the register to different scale classes, electrical ratings, or time intervals. Standardization on one register ratio with a change in only the multiplier is but one of the many cost-saving methods which is available with only a demand register.

REDUCED INVENTORY . . . The opportunities for reduced inventory are substantial with the use of demand registers. Any stock single-phase or polyphase watthour meter can be converted to a demand meter merely by substituting a demand register. This adaptability which results in reduced inventory and operating costs is unique with demand registers.

IN SERVICE . . . A watthour meter can be readily converted to a demand meter simply by the interchanging of registers. Also, quick,

easy, accurate and low-cost field testing can be realized with demand registers. With the use of a G-E self-checking adapter, the need for elaborate testing equipment is eliminated and costly hours of labor are greatly reduced.

REDUCED TESTING . . . General Electric engineers have released test results which give assurance of increased reliability of demand registers. These tests show that the life of the register rotor has been extended up to 10 years. This fact means that the register will need testing and maintenance only during periodic meter tests.

DIRECT GEAR DRIVE . . . Not only is the register on the same testing basis as the meter but also the demand register possesses the same stability of calibration as the meter. This high accuracy remains unchanged during life, and thus assures reliable operation for years. In comparison with other types of demand metering devices, the register is relatively unaffected by such variables as friction and climate.

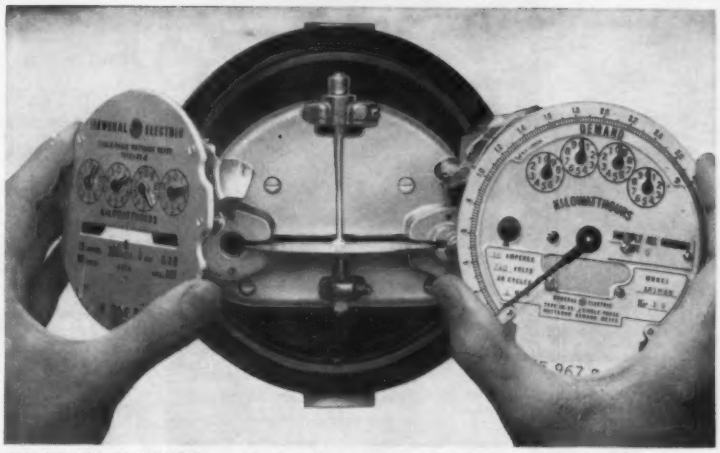
These facts offer you the greatest possible assurance that General Electric's demand registers are your most reliable means to low-cost demand metering.

MANY UTILITIES . . . Increasing numbers of utilities are taking advantage of the benefits offered by demand registers. Here are but a few: Commonwealth Edison Company, Wisconsin Electric Power Company, Kansas Power and Light Company, Duke Power Company, Pacific Gas and Electric Company, Southern California Edison Company, Public Service Company of Oklahoma, and New Orleans Public Service Inc.

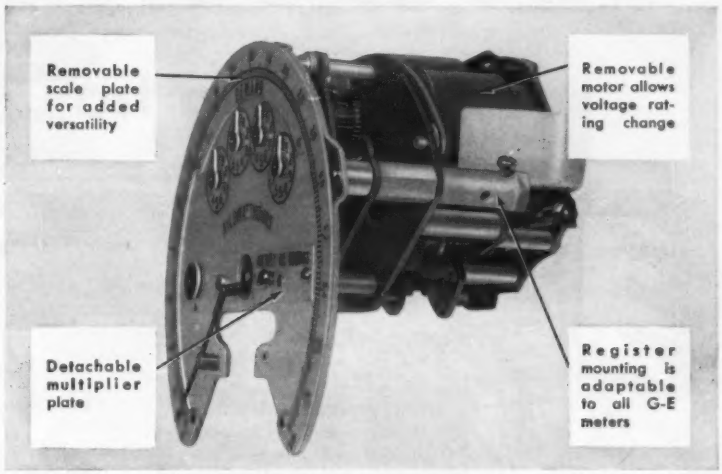
FOR MORE INFORMATION . . . If you would like more information on General Electric's mechanical demand registers, write to Section 621–13, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

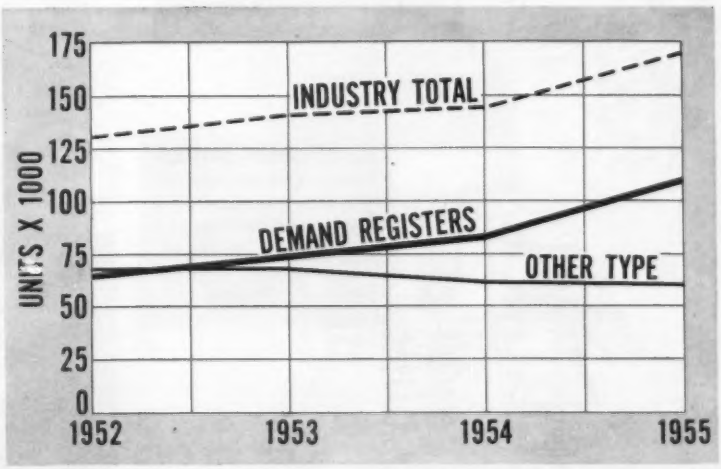
GENERAL ELECTRIC



VERSATILITY OF REGISTER provides installation on any G-E single-phase or polyphase meter.

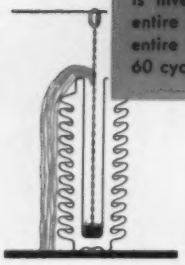

Removable scale plate for added versatility
Removable motor allows voltage rating change
Detachable multiplier plate
Register mounting is adaptable to all G-E meters

FLEXIBILITY OF DESIGN allows change in scale classes, electrical ratings, and time intervals.



INCREASING USE of demand registers has resulted from the dependable low-cost operation.

100% ELECTRICAL TESTING • Soundness of head (where such a ceramic piece is most likely to be cracked) is assured by flashover test of every piece. Before plugging or assembly, porcelain body is inverted, a chain dropped the entire depth of the hole, and the entire unit subjected to a 3-minute 60 cycle flashover.

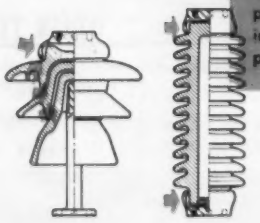


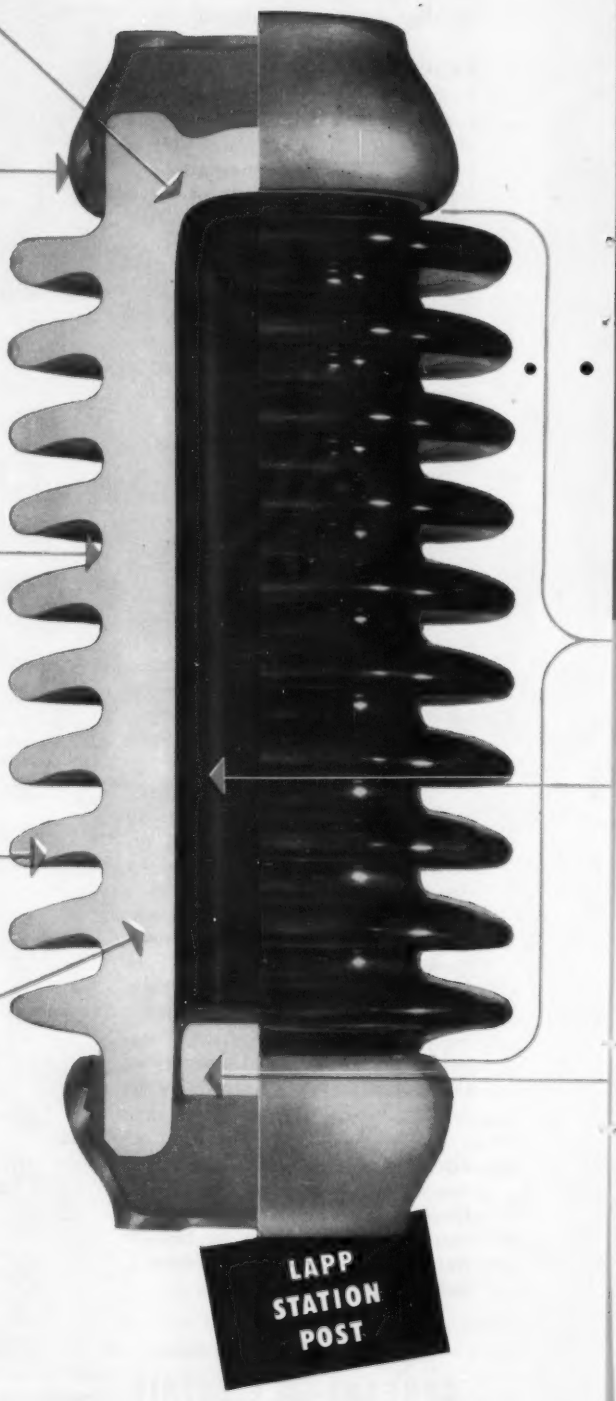
HARDWARE EXTERNALLY ATTACHED • Bases and caps are cemented ON. Porcelain is loaded only in large-area low-intensity compression grip; this eliminates the cause of insulator cracking.

UNIFORM LEAKAGE PATH • Leakage distance secured through multiple short petticoats—*Lapp fog-type design*. Flanges are spaced for natural cleaning action of wind and rain—avoid concentrated hot-spots where local stress can precipitate flashover. This is also the ideal surface for horizontal mounting of insulators.

SHORT STURDY PETTICOATS • Protect body from impact or flashover. Will withstand much more severe attack than required to crack shell-type units, yet will finally break off clean and leave body undamaged.

RIGID UNDER DEFLECTION • One piece porcelain body. No nested porcelain parts, no internal pins, studs or inserts—no internal forces to load porcelain in tension.





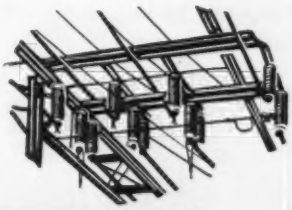
The service record on switch and bus insulators on any major system will show the superiority of Lapp Station Post insulators. Since 1931, these units have been handling dirt conditions, lightning flashover, mechanical shock and loading—with fewer outages, and at lower maintenance and replacement cost, than any other type of station insulator. One reason, of course, is the basic superiority of the design—the Lapp conception of giving mechanical as well as electrical responsibility to a column of porcelain. The other reason is that *Lapp knows how to make 'em*—how to take advantage of the special strengths of porcelain and avoid its weaknesses. The result is the Lapp Station Post; it will improve service and save money on *your* system. Lapp Insulator Co., Inc., Le Roy, New York.

. . . . THE INSIDE STORY

of Station Post reliability

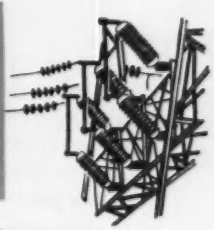
"STRAIGHT-LINE" FLASHOVER • Live terminals are separated by full length of insulator; flashover goes *outside* the unit. Loss of one or more petticoats does not reduce flashover distance.

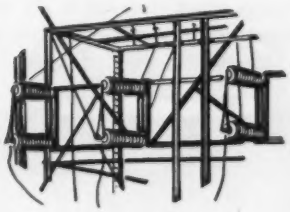
INSIDE GLAZED • All Lapp Post porcelains are glazed inside and outside—a Lapp extra-quality feature that makes for added cleanliness and more critical visual inspection.



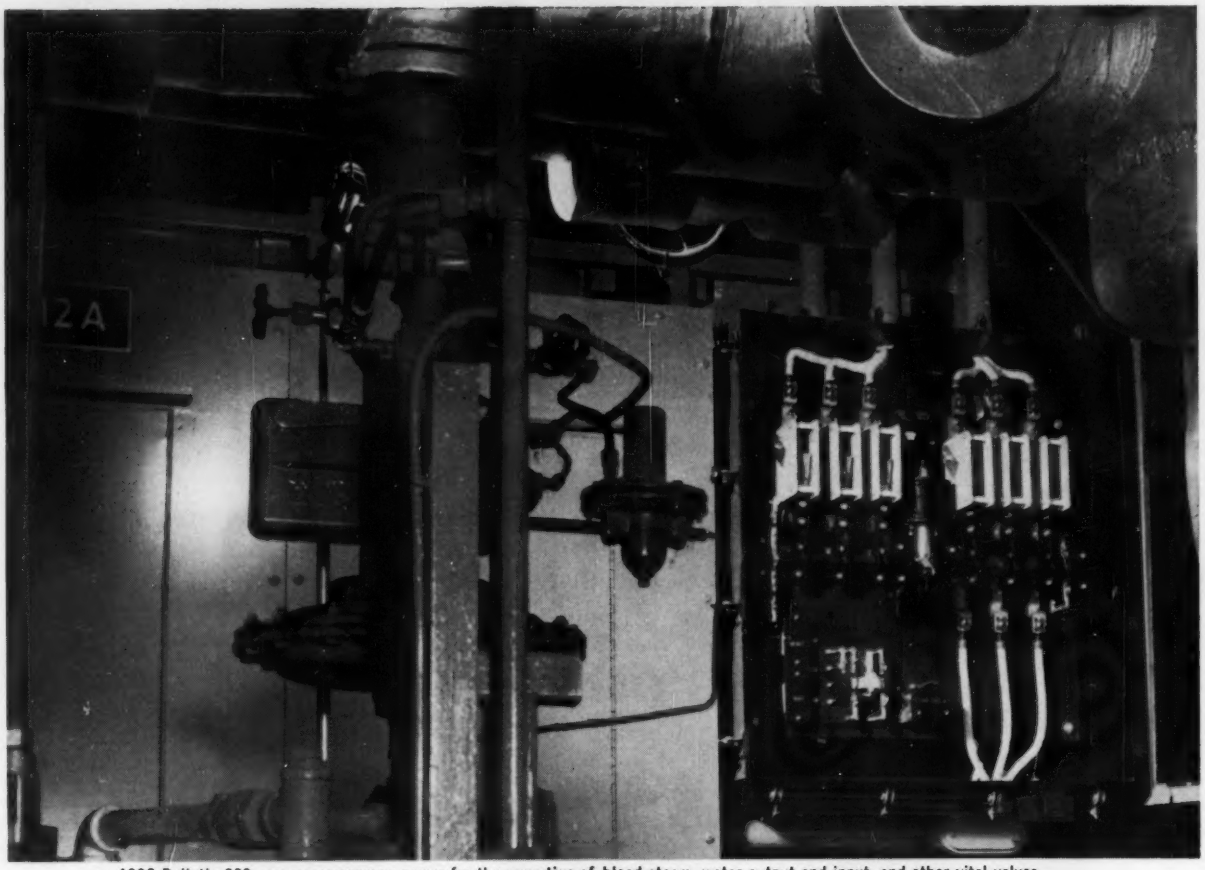
PERMANENTLY PLUGGED PORCELAIN • *After thorough electrical testing*, porcelain body is plugged with porcelain and natural rubber—a Lapp design that has stood the service test of 20 years. This assures a permanently clean, dry hole; avoids internal conductive contamination.

SAME STRENGTH INVERTED • Mount 'em upright, obliquely, horizontally, or inverted—mechanical and electrical characteristics give a safe margin of operating security.





Lapp



ASCO Bulletin 906 assures emergency power for the operation of bleed steam, water output and input, and other vital valves.

FOR ASSURED POWER

ASCO Automatic Transfer Switches
Protect Key Equipment
at Con Edison's Astoria Station

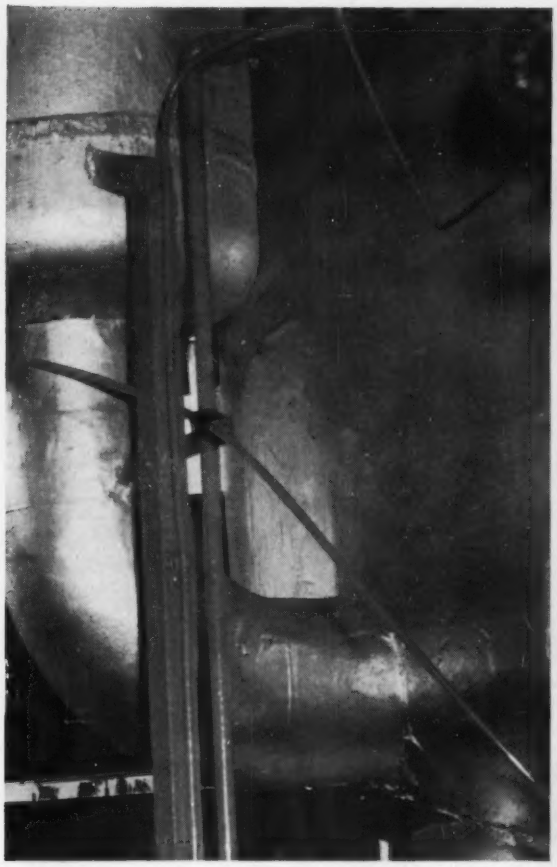
More than 50 ASCO Automatic Transfer Switches were specified by Con Edison for a variety of situations at its Astoria Generating Station, N. Y., where auxiliary power failure could not be tolerated. They protect generators, insure operation of key valves and control panels, stand ready at all times to transfer loads to alternate sources when normal power fails.

They must be dependable.

Dependability in an automatic transfer switch stems from several features. It must be designed for *continuous duty* in either normal or emergency position. The switch must be able to close safely on inrush currents 20 times full load rating so that contacts will not weld on tungsten lamp load.

Other features include *inherent* interlocking, precluding the possibility of both circuits being open or closed . . . *mechanical locking*, providing high contact pressure, minimum I^2R losses, and assuring that vibration or electromagnetic effects cannot open the con-

AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROLS



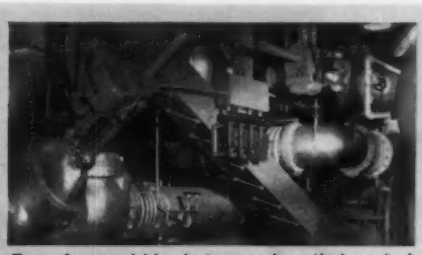
CONTINUITY

tacts . . . *single coil design,* providing construction simplicity, quiet operation . . . *built in time delay* so the equipment ignores harmless momentary outages.

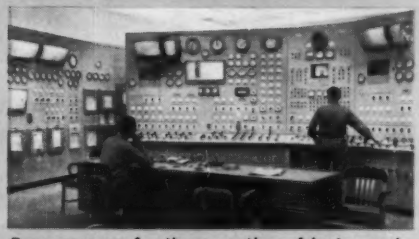
Only ASCO Automatic Transfer Switches satisfy all these essentials in addition to the nominal requirements of transfer switches. For this convincing reason, many engineers are today specifying ASCO — *the one source for a full line of absolutely dependable automatic transfer switches.*

WRITE NOW FOR PUBLICATION 596 DESCRIBING HOW TO SELECT AN ADEQUATE AUTOMATIC TRANSFER SWITCH.

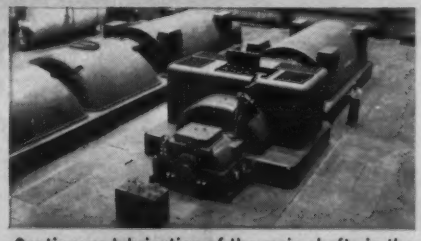
AUTOMATIC SWITCH COMPANY
391 LAKESIDE AVENUE
ORANGE, NEW JERSEY



Two of several bleed steam valves that control the flow of steam from turbines to the main condensers.



Power source for the operation of instruments on the control panel must not fail. Several ASCO units are used here.



Continuous lubrication of the main shafts in the turbo-generators is assured by auxiliary pumps shown in the photo below. The power for this equipment is assured by an ASCO Automatic Transfer Switch.

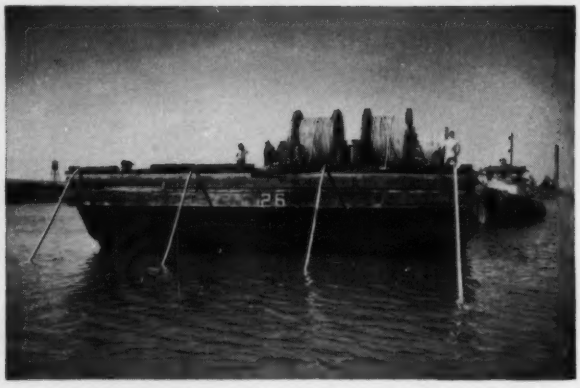
Inspector checks the oil level in the auxiliary lubricant pump for the generators.

ASCO®

DEPENDABLE CONTROL

FIRST INSTALLATION in the Tiger Brand Submarine

The first step. Cable is winched to shore where it is terminated at top of pole. This is only one of four such cables.



Barge begins to move across river. The four cables are kept about 10 feet apart all the way. 4th cable is a spare for future use.

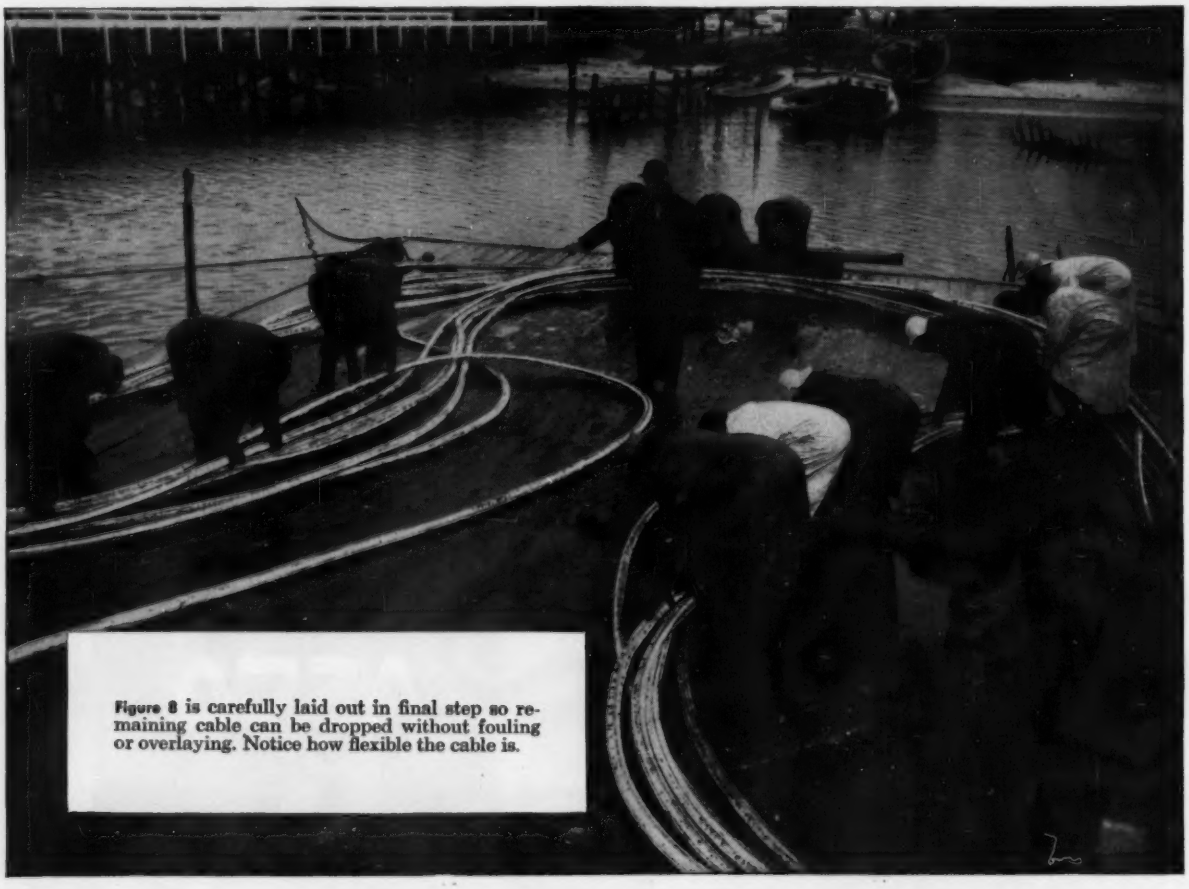


Figure 8 is carefully laid out in final step so remaining cable can be dropped without fouling or overlaying. Notice how flexible the cable is.

United States:

Cable with aluminum armor —in salt water

VIRGINIA ELECTRIC & POWER COMPANY has been using Tiger Brand for 31 years—but the installation shown here features a radical departure from standard cable constructions. To span the brackish Elizabeth River, VEPCO sunk four 3000 ft. single conductor 500 MCM paper lead cables rated at *38,000* volts. The armor is #6 BWG aluminum alloy type 52S-H34, covered with asphalt and jute.

This new aluminum armor is 70% lighter than conventional armor, so it will be much easier to lift the cable if it fouls. The company expects 20 to 30 years of service from the cable.

Why they picked aluminum armor: Because of its non-magnetic properties, the aluminum armor reduced power losses, and it reduced reactive voltage drop. The light weight was also a factor, since it made repairs easier. Extensive tests indicated that corrosion would not be a problem, even in these saline waters.

Just name your expected operating conditions—and there's a good chance that we can supply a standard Tiger Brand cable to do the job. High voltage underwater power cable, flexible dredge cable, cable for power shovels, mine cars or portable hand drills . . . Tiger Brand is designed for those unusual applications where highest possible quality is a must. Call your American Steel & Wire representative.

Here, J. F. Crofton, an independent diver, goes to the bottom to check for fouling. Cables lie in 5 to 10-foot-deep trench, will operate at 34.5 KV.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL
GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

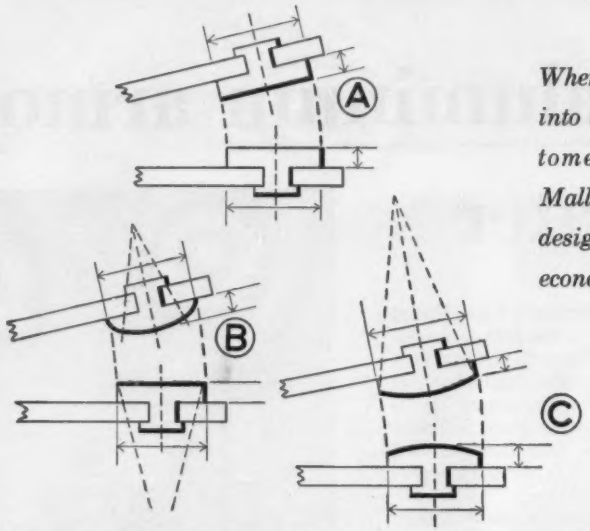
A STANDARD TIGER BRAND CABLE FOR EVERY SPECIAL JOB!

- asbestos wire and cable
- mold cured portable cord
- aerial, underground and submarine cable
- shovel & dredge cable
- paper & varnished cambric cable
- machine tool & building wire
- special purpose wire & cable

USS Tiger Brand **ELECTRICAL WIRE & CABLE** USS

UNITED STATES STEEL

MALLORY



When Original Design A ran into alignment trouble, the customer proposed design B. Mallory engineers recommended design C as the most efficient and economical solution.

How economical are *your* contact designs?

Mallory Contact Engineering Offers Five Ways To Improve Economy

1. **The most effective contact material** from the extensive line developed by Mallory. More economical alloys often can satisfy *actual* service conditions.
2. **The most economical contact design . . .** for your purchasing, production and product needs.
3. **The most economical backing material** . . . from a group of Mallory alloys developed for this use.
4. **The most economical backing member design . . .** in relation to contact and product design requirements.
5. **The most economical method of assembly** of contact and backing member.

By coordinating *all* these important elements of contact design, Mallory can help you put into effect a long-range plan for cutting contact cost and assuring peak performance.

DESIGN of electrical contacts is an engineering job in which Mallory's specialized experience can often lead to substantial savings for you. A case in point—a manufacturer of circuit breakers wanted to use a combination of flat and radius-faced contacts to lick an alignment problem in production. This design required buying and stocking of two separate contact parts.

Mallory contact engineers came up with a money-saving improvement. They recommended a modified radius design to go on both the stationary and moving contacts. Substantial production time was saved by elimination of the alignment difficulty in assembly. In addition, by buying a *single* type of contact engineered for the job, instead of two separate designs, the manufacturer cut his inventory problem in half, simplified purchasing and handling, and saved a significant percentage of direct contact cost as well.

There's a good chance that you can realize comparable savings on your own contact applications, by bringing your problems to Mallory specialists. The complete engineering job that our staff can undertake will assure you of gaining the maximum in performance . . . at the peak of economy . . . for your specific requirements. For a consultation, write or call Mallory today.

Expect more . . . get more from

Serving Industry with These Products:

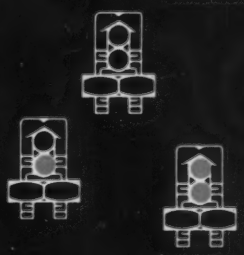
Electromechanical—Resistors • Switches • Television Tuners • Vibrators
Electrochemical—Capacitors • Rectifiers • Mercury Batteries
Metallurgical—Contacts • Special Metals and Ceramics • Welding Materials

P. R. MALLORY & CO. Inc.
MALLORY
P. R. MALLORY & CO., Inc., INDIANAPOLIS 6, INDIANA

first...
and still the finest

SPLIT BOLT CONNECTORS

KEARNEY CON-NEC-TITES



Since the first split bolt connector was introduced by KEARNEY in 1926, it has had many imitations. But the famous Con-Nec-Tite has never been equalled because KEARNEY has constantly kept making it better. New materials and new design features have made it stronger and more versatile.

Today's all-purpose Con-Nec-Tite is fully plated. It can be used interchangeably for aluminum to aluminum, aluminum to copper or copper to copper connections.

JAMES R. KEARNEY CORPORATION • 4224-42 Clayton Ave., St. Louis 10, Mo. • *Canadian Plant:* Guelph, Ont.

-303

for BETTER CONSTRUCTION
SAFER MAINTENANCE
Specify
JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.
The Mark of Quality
KEARNEY PRODUCTS

Roller-Smith

PROUDLY ANNOUNCES the NEW...

UNI-BUS BUSWAY

A New Concept in busway systems that obsoletes all other methods of carrying current.

- Low Voltage Drop in ***PLUG-IN*** AND ***FEEDER*** TYPES.
- High Short Circuit Strength in ***PLUG-IN*** AND ***FEEDER*** TYPES.
- ***ONE FLEXIBLE FITTING*** makes elbows, offsets —simplifies engineering and eliminates costly delays.
- ***COMPLETE SAFETY*** because live bus bars at plug outlets and live connections in plugs are eliminated.

And All at Lower Cost!

Roller-Smith
CORPORATION
ELECTRICAL SWITCHGEAR
BETHLEHEM, PENNSYLVANIA

ECONOMY

New clip-on hanger and lighter weight busway mean less installation time. Feeder system often costs less than conduit and wire, yet is 100% reusable.

FLEXIBILITY

Flexible connector eliminates all special fittings so that a minimum number of components meet all job requirements. Plug-in and feeder systems interchangeable.

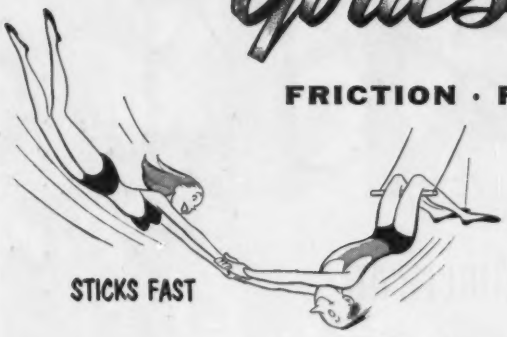
SAFETY

Interlocked safety slide over plug outlet cannot be opened until covered by plug. Interlocked cover and visible contacts in plug are positive assurance of safety.

For top value . . . in any type . . . get JENKINS

Gold Seal Tape

FRICTION · RUBBER · PLASTIC



STICKS FAST

GUARANTEED FOOTAGE

MOLDS EASILY

SPEEDS THE JOB

CELLOPHANE PROTECTED

BEST BUY FOR PLANT SUPPLY

TRADE JENKINS MARK SINCE 1868 Jenkins Bros.

All types of GOLD SEAL TAPE — Friction, Rubber, Plastic — are packed in 10-roll cartons as well as single rolls. Every roll cellophane-protected, stays fresh. Jenkins Bros., Rubber Division, 100 Park Ave., New York 17.

DIAMOND SEAL
Friction and Rubber Tape are also made by Jenkins Bros. to ASTM specifications.

American Creosoting Company

Pioneers in Forestry as well as Wood Treatment

• It has been estimated that the modern wood preserving industry, pioneered by the American Creosoting Company, has saved the nation the equivalent of 500 million acres of forest lands in the past 50 years. Great as this force has been, wood preservation alone was not enough to stem the tide of forest exhaustion.

The greatest conservation force is the forester and his science of forestry.

Just as it was the pioneer in wood preservation, American Creosoting Company was a pioneer in forestry. While the science of forestry was in its infancy, American Creosoting Company took a practical interest in the advancement of the science by purchasing large forest areas to make them available for the study and advancement of the practices of good forestry.

In this vast woodland laboratory, known as Satilla Forest, Amcreco has helped develop and carry out many of the scientific practices that are now in widespread use throughout private, industrial and government owned timber lands.

With this progressive policy of good forestry practice combined with constantly improving treatment, American Creosoting Company helps keep the cost of treated materials at a minimum consistent with the quality you require. To learn how this affects you, let us quote on your needs.

AMERICAN CREOSOTING COMPANY

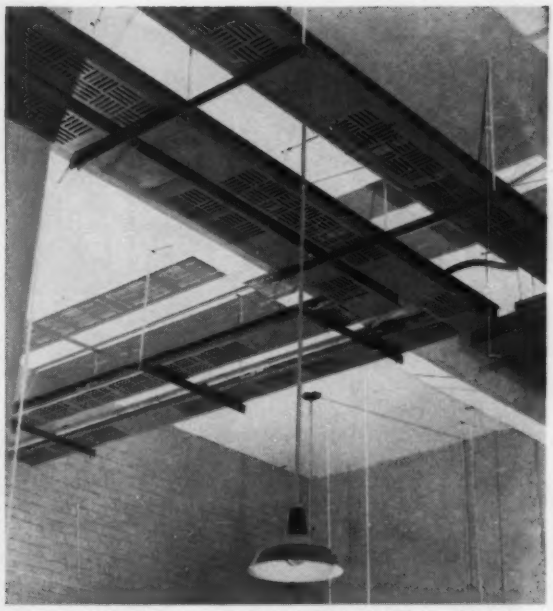
Shreveport Creosoting Company
Colonial Creosoting Company
Federal Creosoting Company
Indiana Creosoting Company

AMCRECO
LOWRY PROCESS
CREOSOTED WOOD

Georgia Forest Products Company
Gulf States Creosoting Company
Georgia Creosoting Company
Kettle River Company

LOUISVILLE 2, KENTUCKY
12 FIELD SALES OFFICES TO SERVE YOU

Sub-stations using Kaiser Aluminum tubular conductor combine efficiency and economy.



Duct systems cost less, are easier to install with Kaiser Aluminum rectangular bar.

For big savings on bus costs . . . think of Kaiser Aluminum

YOU SAVE on material costs when you specify Kaiser Aluminum bus conductors instead of copper for an equivalent installation.

That's because lightweight Kaiser Aluminum not only costs less per pound of material than copper, but takes only one-half the number of pounds for equal conductivity.

In addition, the light weight of Kaiser Aluminum bus makes installation easier, faster, more economical.

On your next bus installation, take advantage of Kaiser Aluminum's unique combination of properties including high conductivity, light weight, corrosion-resistance, workability, strength, and economy. Available in rectangular, solid round and tubular shapes in a wide range of sizes and constructions.

For complete information, contact the Kaiser Aluminum sales office listed in your phone directory, or your nearby Kaiser Aluminum distributor. Kaiser Aluminum & Chemical Sales, Inc. General Sales Office, Palmolive Bldg., Chicago 11, Illinois; Executive Office, Kaiser Bldg., Oakland 12, California.

Joining Kaiser Aluminum bus conductor by welding, brazing, or soldering, can be done easily with suitable equipment and little training. ▶

NEW 12 PAGE BROCHURE FREE UPON REQUEST

Availabilities, properties, advantages and methods of joining and bending aluminum electrical bus conductors are detailed in this new 12 page brochure. For your free copy, please mail the coupon at right.

Kaiser Aluminum & Chemical Sales, Inc.
Industrial Service Division
1924 Broadway • Room 202 • Oakland 12, Calif.

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Title_____
Company_____
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Ozone didn't K.O. this cable!

shock-tested for 6000 hours

U.S. ROYAL MASTER power cable still stands up!

Amazingly better than *any* of the five leading brands tested!

United States Rubber Company technicians tested U. S. Royal Master Power Cable against 5 leading competitive brands. Here's the test, and the results:

A sample of 5 KV unshielded U. S. Royal Master Power Cable and 5 other competitive cables were each bent into a U-shape, roughly 8 times overall diameter. Placed upright on a grounded metal plate, a conductor-to-plate potential of 40,000 volts was applied. All 5 competitive cables failed within 20 minutes to 35 hours. The U. S. Cable was still going strong after 6000 hours!

No other cable approaches U. S. Royal Master in performance and economy. Order cable from your distributor or write Electrical Wire and Cable Dept., United States Rubber Company, Rockefeller Center, New York 20, N. Y.

Adequate Wiring can be the two most important words in your manufacturing economy. Obsolete wiring can cause power failure, increase maintenance expenses and reduce your production. Make sure your present wiring is not only adequate for today's power needs, but also sufficient to carry the ever-increasing electrical loads required in your future growth.

US RUBBER

Electrical Wire and Cable Department

United States Rubber

GOES ANYWHERE...
TACKLES ANY JOB!

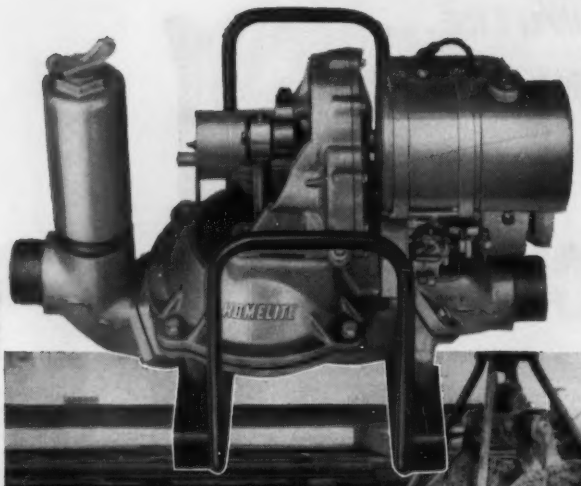
Best Digger Truck Going!

In more and more utility operations, it has become standard operating practice to depend on FWD trucks for digger work. They'll travel and work on any line job . . . as fast as any other truck. But they have a built-in reserve for emergencies . . . going and working where conventional trucks can't even travel. For the tightest traction in the roughest going . . . on any road condition, over any terrain, you'll get there faster, surer, safer with FWD digger trucks. Frames are designed to take digger twist and stress. And FWD's scientific weight distribution lets you haul more working weight on the powered front axle. For any utility line assignment, in any kind of weather, you'll give better service with less lost time, with FWD—the *best digger truck going.*

THE FOUR WHEEL DRIVE AUTO COMPANY
CLINTONVILLE, WISCONSIN • *Canadian Factory* • KITCHENER, ONTARIO

Whether you want rear diggers, or the front-mounted derrick and digger, FWD has them both in any weight you need for your own line construction and maintenance.

BUILDERS OF AMERICA'S FOREMOST HEAVY-DUTY TRUCKS
MATH-O-MATIC DESIGN



NEW HOMELITE Diaphragm PUMP

for All Heavy-Duty jobs*

This new, job-tested Homelite diaphragm pump will handle *all* your heavy-duty jobs with greater ease and mobility.

Its new internal design not only pumps up to 5000 gallons per hour but handles sand, mud, solids and muck with equal ease. Because it weighs only 120 pounds, it goes anywhere quickly and easily . . . saves money in labor and haulage costs.

The entire unit construction is keyed to smooth, continuous performance. Flapper valves have special self-cleaning action to prevent clogging. The accumulator holds flow at a steady rate. Gears are totally-enclosed for full protection. Spring skids provide steadier footing, reduce vibration.

Write or call your nearest Homelite representative for complete information or a free demonstration.

**120 pounds for easier carrying*

Model 20DP3 has guaranteed suction lift up to 28 feet and total head up to 50 feet, including friction.

Manufacturers of Carryable
PUMPS
GENERATORS
BLOWERS
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HOMELITE

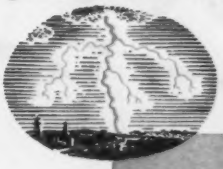
A DIVISION OF TEXTRON AMERICAN, INC.
6102 RIVERDALE AVE., PORT CHESTER, N. Y.

How **sure** are you

that you have good performing

grounds

?

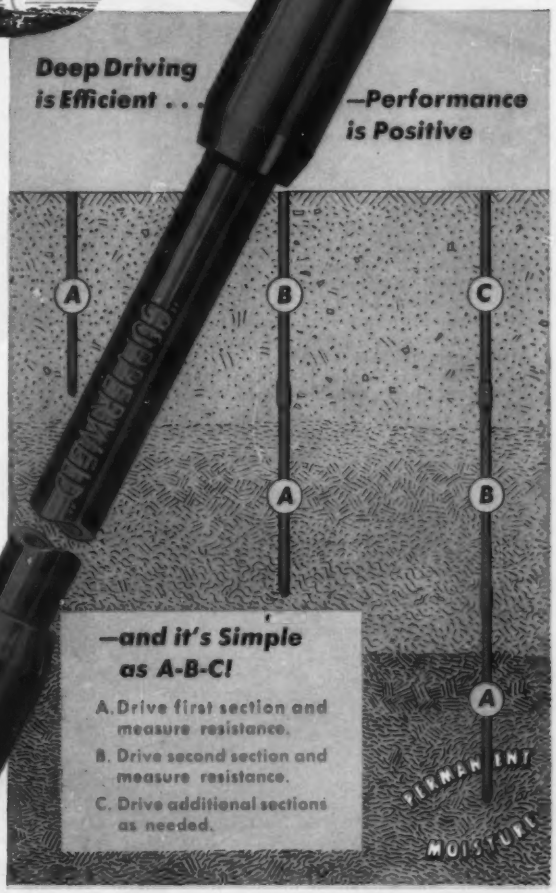


Driving a single ground rod into the soil doesn't necessarily mean that you have a good ground!

First, you must be sure that your connection has a low resistance to earth—the measure of electrical effectiveness. The safest way is to use a ground testing meter. If the resistance is high you need additional rods, spaced from the first, and connected in multiple—*or better yet*, use the new deep grounding method. Tremendous improvements in ground resistance have been obtained with Copperweld* Sectional Rods driven to depths of 20, 30, 40 feet or more. These rods penetrate low-resistance soils, where the moisture is permanent. Thus, you have a dependable ground the year 'round.

To be really sure, use Copperweld, for then you know that the ground rod will not have rusted out when you need it, and that you always have dependable copper-to-copper connections.

*Trade Mark



connect to

Copperweld TRADE MARK **sectional ground rods**

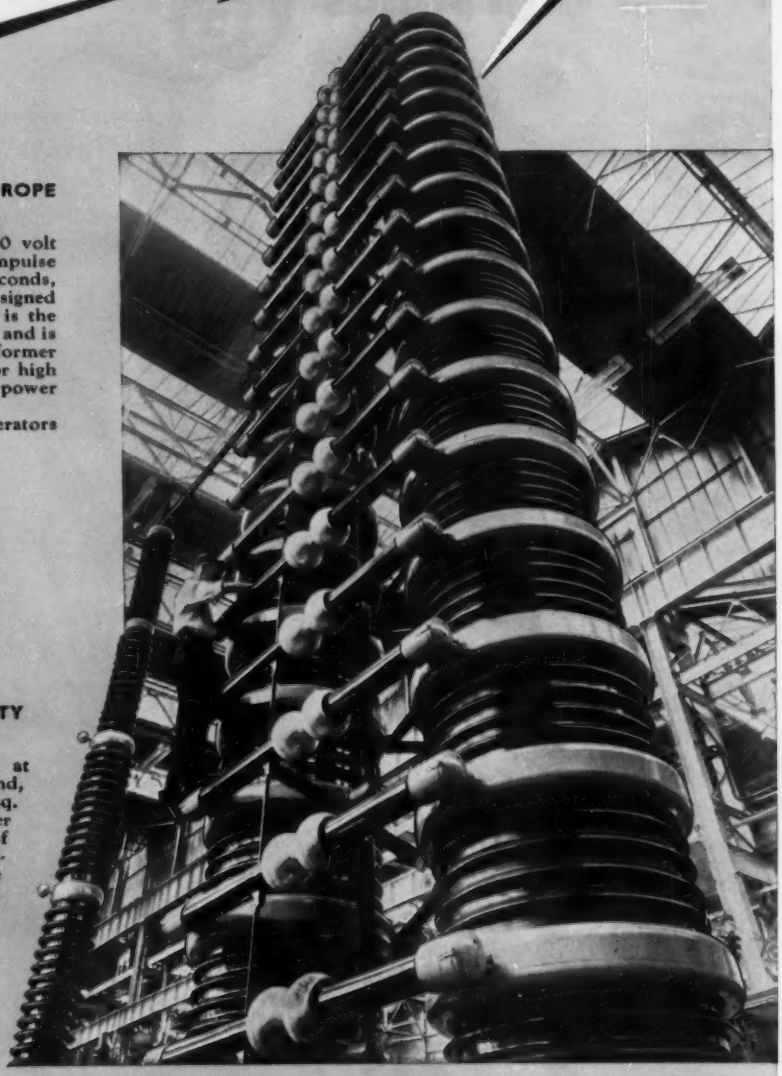
COPPERWELD STEEL COMPANY

WIRE AND CABLE DIVISION, Glassport, Pa.

For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

—to be sure!

4,000,000 VOLTS!



THE LARGEST
IMPULSE GENERATOR IN EUROPE

The illustration shows a 4,000,000 volt 18 stage, 2 column Ferranti Impulse Generator, energy rating 285 kW seconds, D.C. charging 220 kV per stage. Designed and built by Ferranti engineers, it is the largest impulse generator in Europe and is now installed in the Ferranti Transformer Factory at Hollinwood, England for high voltage impulse testing of large power transformers.
Ferranti High Voltage Impulse Generators are used throughout the world.

FERRANTI

OVER 5,000,000 kVA
per annum
of TRANSFORMER CAPACITY

The Ferranti transformer plant at Hollinwood, Lancashire, England, covering an area of over 300,000 sq. ft. has a manufacturing capacity per annum of over 5,000,000 kVA of Large Power Transformers, Distribution Transformers, Voltage Regulators, High Voltage A.C. and D.C. Impulse Testing Plant and Specialised Equipment. Contracts include the supply of transformers for the Garrison Dam and McNary Dam Projects in the U.S.A. and the Alcan Project in Canada.

FERRANTI LTD

Head Office and Plant: **HOLLINWOOD · LANCASHIRE · ENGLAND**

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NEW YORK · Ferranti Electric Inc., 30 Rockefeller Plaza, N.Y. 20
TORONTO: Ferranti Electric Ltd., Mount Dennis, Toronto 15, Ontario
MANCHESTER, ENGLAND: Ferranti Ltd., Moston, Manchester 10
EDINBURGH, SCOTLAND: Ferranti Ltd., Ferry Road, Edinburgh 5

Public Service Co. of Indiana, Inc. communicates by G-E 2-way radio

Radio covers its entire system

All three operational divisions of the Public Service Company of Indiana depend upon General Electric 2-way radio to help coordinate the state's supply of vital electricity.

The all-duplex installation operates on the 25-50 mc band. District offices and generating plants maintain radio contact with service trucks and repair crews. Thanks in part to radio control, a continuous supply of electricity is generated and delivered to homes, municipalities, business and industry in 70 of the state's 90 counties.

Fourth year of service

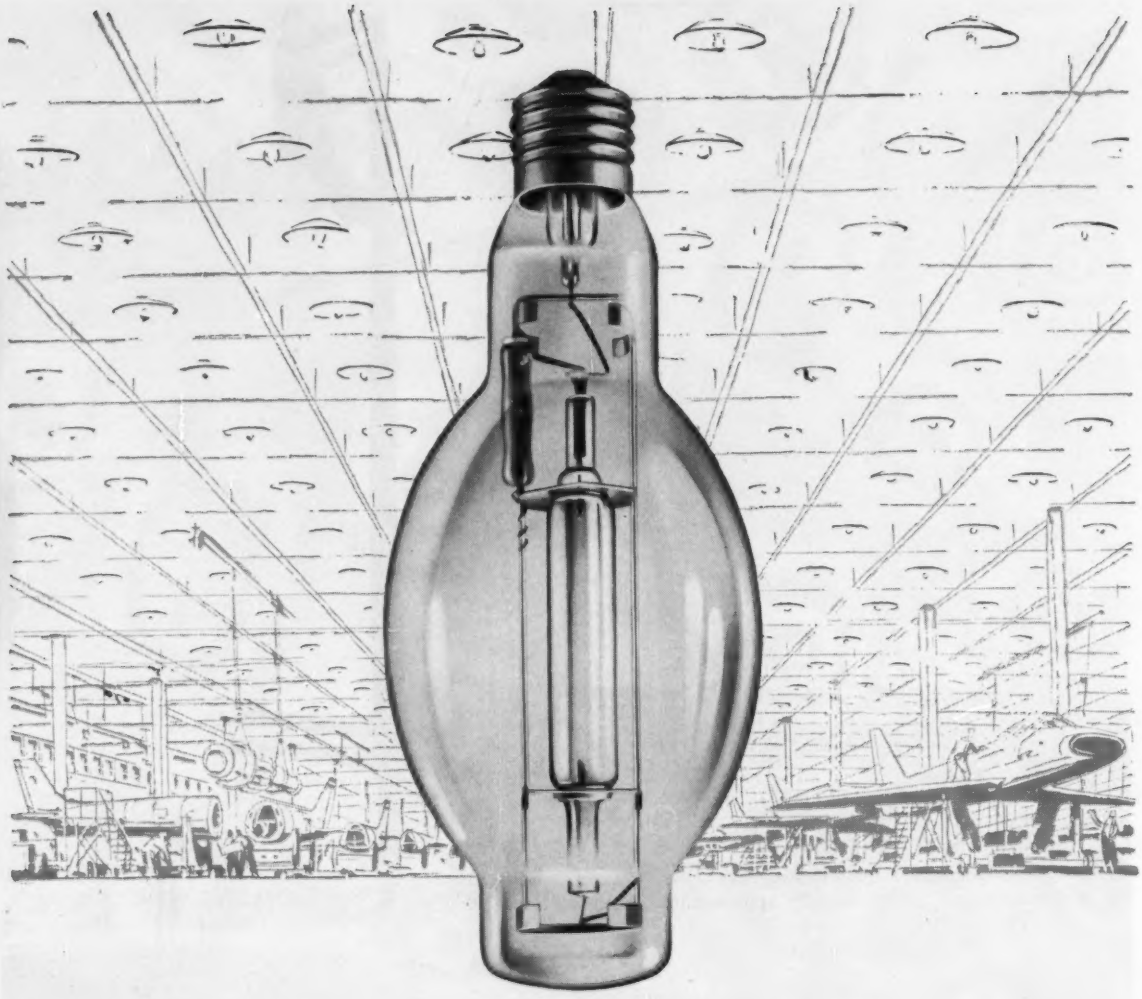
For nearly 4 years, the G-E system has provided efficient radio service from 37 independent base stations. These coordinate the activities of more than 250 G-E equipped mobile units on 24-hour duty throughout the state.

2-WAY MOBILE RADIO

General Electric's new Progress Line of 2-way radio is available now to help your utility operations. Call in your G-E Communications Counselor, or write: *General Electric Co., Communication Equipment, Section X 1926-20, Electronics Park, Syracuse, New York.*

Progress Is Our Most Important Product

GENERAL ELECTRIC



40 feet up...yet all the light you need at "SEE" level!

Lighting fixtures and lamps must be way up high in airplane factories, steel mills, sports arenas and similar buildings. This means that lamps must be unusually powerful for sufficient light to reach the floor area.

Among the most efficient light sources ever developed for "high bay" uses is the Sylvania Mercury Vapor Lamp. It gives brilliant blue-white light that has high illuminating power. What is more, this remarkably efficient lamp gives more light per operating dollar than practically any other lamps suitable for high bay operation.

For special applications, where color appearance is important, the Sylvania Color-Improved Mercury Vapor Lamp is particularly useful.

Because of their outstanding economy of operation and high output of usable light, Sylvania Mercury Vapor Lamps are widely used for street and highway lighting, too . . . helping to keep your taxes down, making nighttime driving safer.

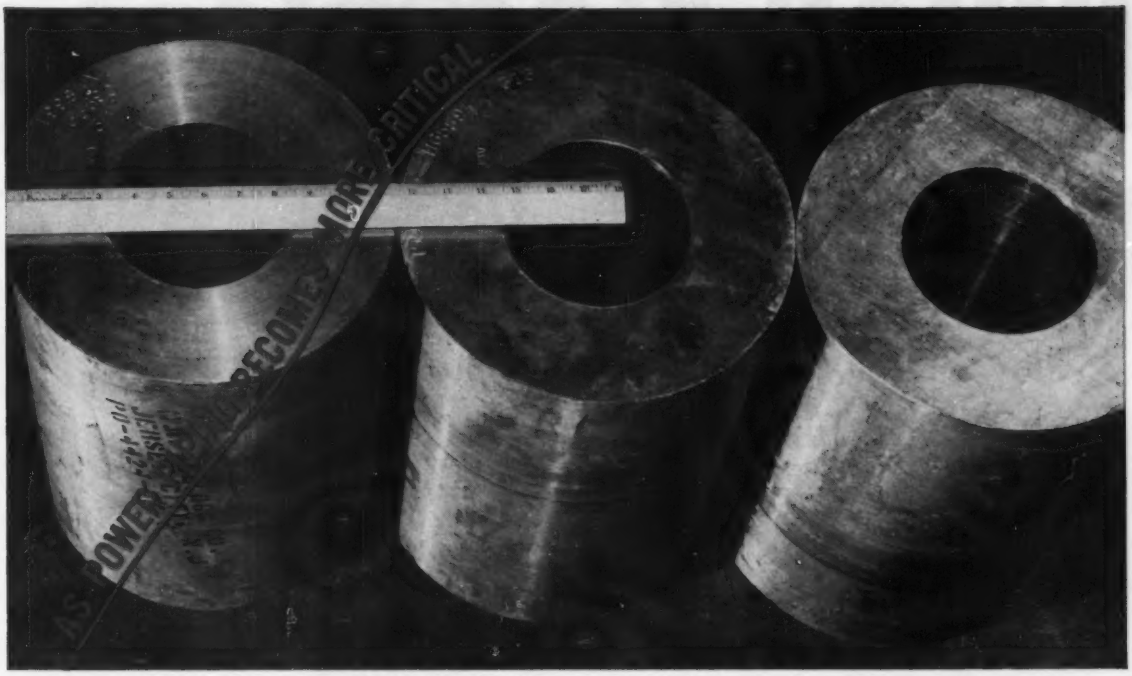
If you have a lighting problem you believe Sylvania Mercury Vapor lighting will solve, phone or write your nearest Sylvania office. For technical and application data, write directly to:

SYLVANIA ELECTRIC PRODUCTS INC.
Lighting Division, Salem, Mass.
In Canada:
Sylvania Electric (Canada) Ltd.
University Tower Building, Montreal

SYLVANIA

...fastest growing name in sight

LIGHTING • RADIO • ELECTRONICS • TELEVISION • ATOMIC ENERGY



Heavy-walled sections of new and existing alloys, most never before used for the purpose, are tested and evaluated by Kellogg toward improving design and performance of main and reheat steam piping.

M. W. KELLOGG METALLURGY KEEPS PACE

With wall thicknesses of main and reheat steam piping for current steam-electric power plants already approaching the upper limits of practicality, supercritical pressures and temperatures present a multiplicity of metallurgical problems to the power piping designer and fabricator. New and stronger stable alloys must be developed, new welding materials found, and new welding techniques and heat treating procedures perfected.

At The M. W. Kellogg Company, new materials containing alloying elements such as molybdenum, cobalt, tungsten, nitrogen, and titanium —in addition to chromium, nickel, and columbium—are now being investigated for long term high pressure service to 1300 deg. F. Most have never before been used for main or reheat steam piping. Heavy-walled sections of these materials are welded, tested, and evaluated by every known technique at Kellogg's Jersey City metallurgical laboratories.

The results of these continuing studies will prove extremely valuable to consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.

FABRICATED PRODUCTS DIVISION
THE M. W. KELLOGG COMPANY, 225 BROADWAY, NEW YORK 7, N.Y.
The Canadian Kellogg Company, Ltd., Toronto • Kellogg International Corp., London
SUBSIDIARIES OF PULLMAN INCORPORATED

Sections of piping are welded, using various materials and techniques, and then tested for strength and other characteristics.

POWER PIPING—THE VITAL LINK

UNION ELECTRIC adds

Unit No. 3 at MERAMEC STATION will be served by a Foster Wheeler twin furnace, dual circulation, differentially fired, reheat steam generator of 1,850,000 lb/hr capacity

With the addition of this 275,000-kw Unit No. 3 at Meramec Station, Union Electric Company of Missouri will boost total station capacity to 560,000 kw, keeping well ahead of anticipated load growth.

The new turbine will be served by an FW steam generator with a maximum continuous capacity of 1,850,000 pounds steam per hour, 2150 psig at the superheater outlet, 1010F/1010F. This unit is unique in that it combines twin furnace arrangement, dual circulation and reheat—three major advances in modern, large capacity steam generator design. The selection of this combination is a gratifying expression of confidence in the efficiency and dependability of Foster Wheeler steam generating equipment.

The twin furnace design, a Foster Wheeler development, provides sufficient water-cooled and steam-cooled areas to prevent slagging of boiler and superheater surfaces. The use of combination radiant and convection surfaces for superheating, plus differential firing, permits constant final and reheat steam temperatures over a wide operating range, stabilizing steam conditions for maximum turbine efficiency.

Dual circulation, another Foster Wheeler development, has been incorporated as insurance against potentially troublesome silica deposition in the turbine.

Coal for the differential-fire-controlled furnaces will be pulverized in three Foster Wheeler Ball Mills.

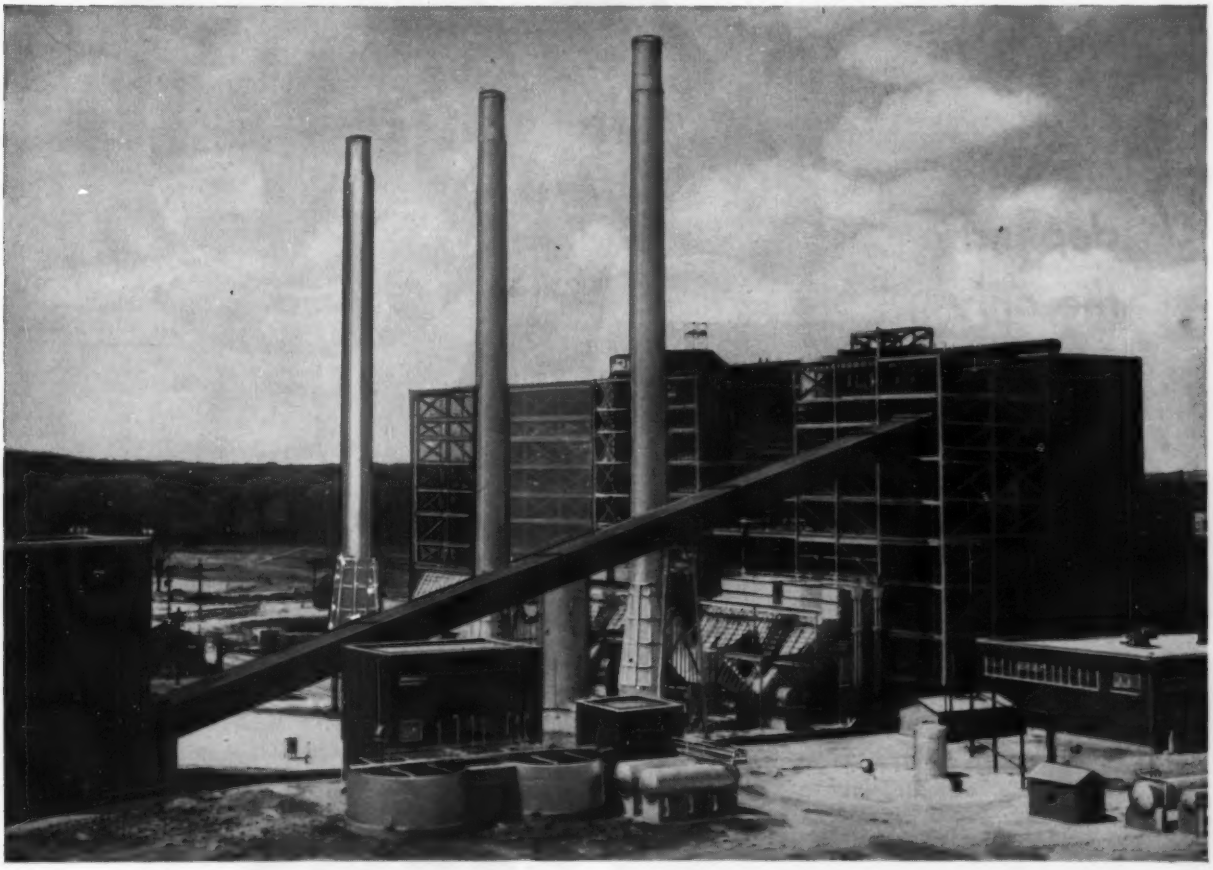
The proved dependability and long-range economy of Foster Wheeler steam generators are backed by more than 50 years of experience in pioneering power plant equipment. We will be pleased to quote on your requirements. *Foster Wheeler Corporation, 165 Broadway, New York 6, N. Y.*

STEAM GENERATORS
SURFACE CONDENSERS
FEEDWATER HEATERS
HEAT EXCHANGERS

FOSTER

NEW YORK • LONDON

1,850,000 lb steam per hr!



The above photograph of Union Electric's Meramec Station shows, in color, the new Unit No. 3 as it will appear when the addition is completed in 1958. With a capacity of 275,000 kw, Unit No. 3 will increase the total output of Meramec Station to 560,000 kw. keeping system capability well ahead of maximum anticipated load growth.

Reddy Kilowatt

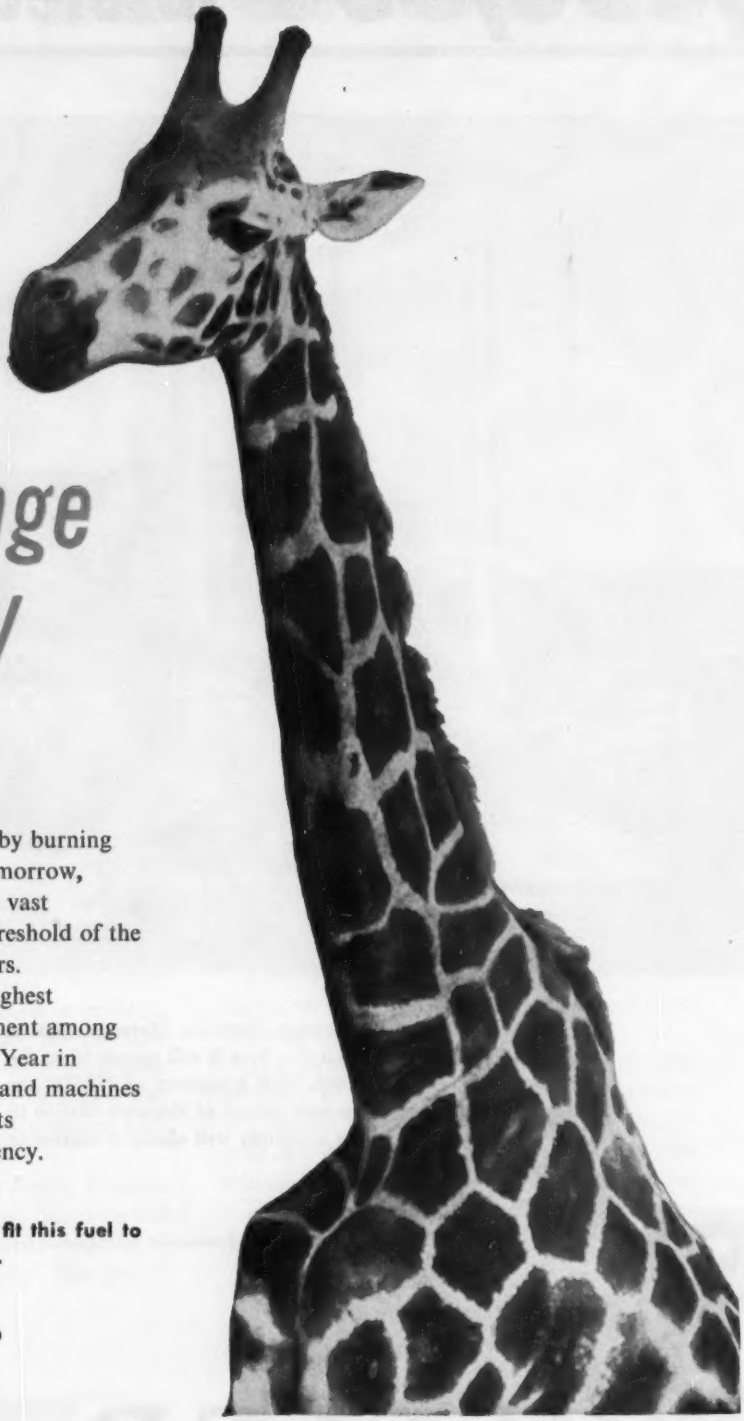
• Trade mark character used by permission of Reddy Kilowatt, Inc.

WHEELER

• PARIS • ST. CATHARINES, ONT.

ECONOMIZERS
BALL MILL PULVERIZERS
COOLING TOWERS

UNCERTAIN OPERATING COSTS BOTHER YOU?



depend on the only

long range economy fuel

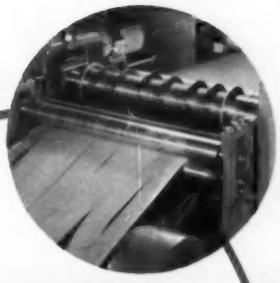
You'll win in the long run by burning Bituminous! Today and tomorrow, supply is unlimited and the vast reserves are right on the threshold of the major manufacturing centers. Bituminous, too, has the highest potential for cost improvement among competing industrial fuels. Year in and year out new methods and machines are designed to control costs and improve burning efficiency.

Let B&O's Technical Service fit this fuel to your long range power plans.
Ask our man!

COAL TRAFFIC DEPARTMENT
BALTIMORE & OHIO RAILROAD
Baltimore 1, Maryland
Phone: LExington 9-0400

BALTIMORE & OHIO RAILROAD
BITUMINOUS COALS FOR EVERY PURPOSE

MOLONEY ELECTRIC



SLITTING CORE STEEL

MAKING GOOD TRANSFORMERS BETTER

Ever since the early days of commercial electricity, Moloney has been constantly on the move, developing and producing better transformers. Transformers generally available during the "nineties," had high losses, poor regulation, relatively short thermal life and extreme susceptibility to damage from lightning. Moloney's modern HyperCore Distribution Transformers feature greatly improved losses, excellent regulation, high overload capacity and unmatched resistance to lightning surges.

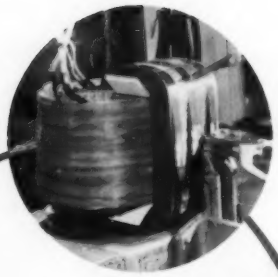
Today's Moloney HyperCore Transformers have wound cores made from grain-oriented, cold-rolled, silicon steel, making possible transformers of smaller physical size, lighter weight and improved loss characteristics. Full advantage of these qualities cannot be realized on production runs of transformers without close control over processing. Care in annealing cores . . . checking the nitrogen atmosphere and controlling the heating and cooling cycle in both time and temperature . . . is of extreme importance. Likewise, care in impregnating, baking and cutting the cores is necessary to maintain top quality. Moloney's quality control engineers constantly check these processes.

CORE WINDING DEPARTMENT

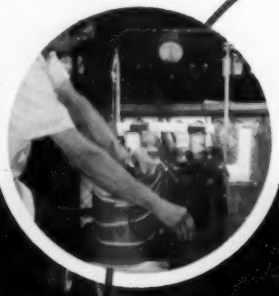
CORE TESTING

MOLONEY ELECTRIC COMPANY, ST. LOUIS 20, MISSOURI

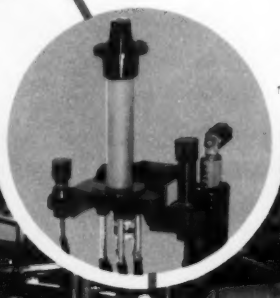
Unlike windings on the "old timers," today's transformer windings are much more than a "bunch of turns" designed to give the proper transformation ratio. Instead they represent a scientific application of insulating materials and cooling ducts designed to provide high resistance to lightning surges, and safe operating temperatures during heavy short-time overloads. These modern windings are stronger mechanically and can better withstand the forces acting under short circuit conditions. Constant inspection and tests keep tab on these qualities . . . research keeps improving them.



ASSEMBLING
CORE-AND-COIL UNITS

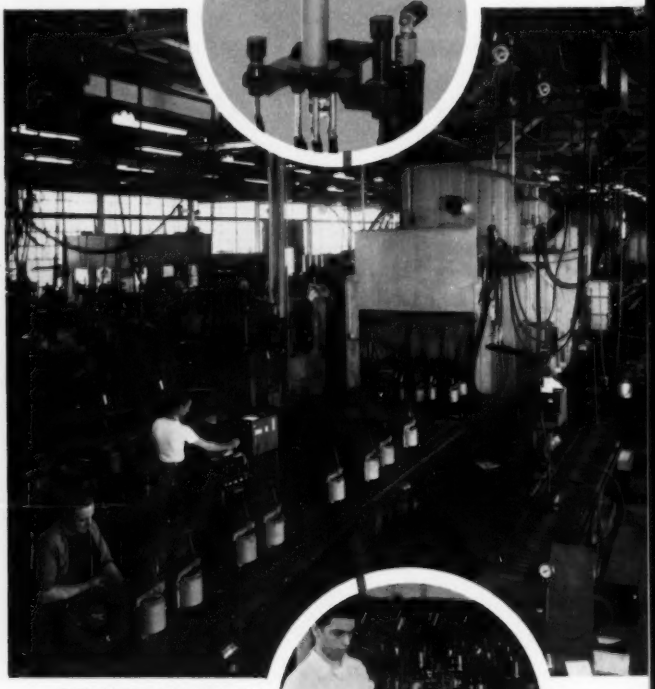


COIL TESTING



TAP CHANGER

COIL WINDING DEPARTMENT



CORE-AND-COIL ASSEMBLY BAY

WINDING COILS

TESTING
CORE-AND-COIL UNITS

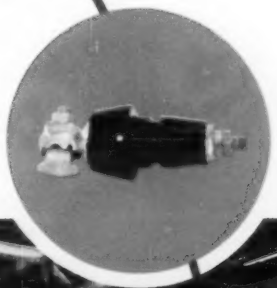
Moloney HyperCore Distribution Transformers get quite a going over before they are crated for shipment. They are tested at various stages of production, as well as at the end of the production line. Coils are tested in the winding department and cores are tested in their department. The core-and-coil assemblies are tested before they are installed in their tanks and again after the transformers are completely assembled. Tests include standard commercial production tests, impulse, audio sound level and radio influence tests.

MOLONEY ELECTRIC

MOLONEY ELECTRIC COMPANY

The ancient "tubs" frequently experienced an early demise because they were "freebreathers." Entrance of moisture and oil sludging due to oxidation took their toll. Not so with today's Moloney transformers with their completely sealed tank design. Moisture and oxygen are sealed out. Other features that research has given the modern HyperCore Transformer are . . . leak-free electronic welding of tanks . . . triple-thick base construction . . . the best in protective paints.

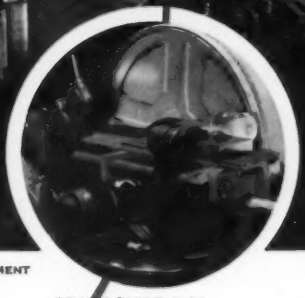
FINAL ASSEMBLY



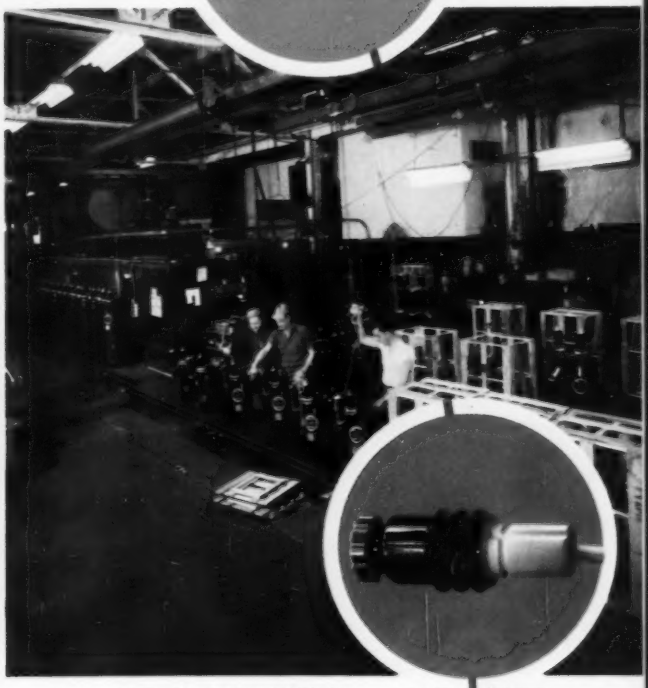
LOW VOLTAGE BUSHING

TANK PAINTING

TANK DEPARTMENT



ROLLING BASE FLANGE



TESTING AND CRATING DEPARTMENT

HIGH VOLTAGE BUSHING

SEAM WELDING TANK WALL

Moisture is removed from windings by vacuum and heat treatment. Air entrained in the transformer oil, and air bubbles that may become trapped in the windings, are removed by vacuum treatment of the entire transformer after assembly. This type of careful processing assures high surge strength.

Naturally today's HyperCore Transformers are provided with many mechanical features that weren't thought of during the early days. These include . . . keyed bushings that won't turn when the terminals are tightened . . . electro-tinplated terminals permitting use of either copper or aluminum conductors . . . high voltage bushings (8.6 Kv and below) with enclosed terminals and insulating knobs for safety and convenience . . . rotary, snap-action tap changers feature high contact pressures . . . and corprene gasket sealed tank covers.

CORPRENE GASKETED COVER

Sixty years devoted exclusively to the design and fabrication of transformers have led to a reputation of quality and performance second to none.

Additional important features and testing procedures are on their way to make certain that tomorrow's Moloney Transformers are even better through Moloney research and quality control.

Litho in U.S.A.

MOLONEY ELECTRIC COMPANY

Power Transformers • Distribution Transformers • Load Tap Changing Transformers • Regulating Transformers • Step Voltage Regulators • Primary Unit Substations • Secondary Unit Substation Transformers • Network Transformers • Series Street Lighting Transformers • Subway Transformers • Industrial Dry Type Transformers • Capacitors • Magnetic Components For Electronics

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MO. AND TORONTO, ONT., CANADA

Challenge of Shopping Centers

The special report on distribution design practices for shopping centers (p 109) points up three areas of mutual concern to store operators and electric utilities. These are service reliability, economy, and appearance.

Each of these assumes a growing importance as shopping center developments continue to grow and spread. Already there are a surprising number of such centers, and they are doing a considerable share of the nation's merchandising. Success of these ventures insures their expansion and emphasizes the need for constantly improved distribution design to serve them.

In many instances the management for shopping center stores is drawn from the downtown business district. This is particularly true of the large department stores opening suburban branches. The men who operate them are accustomed to the out-of-sight and almost infallible power supply of the downtown network. They have not faced service interruptions in merchandising operations where large crowds gather.

On this score, utilities can help in several ways. First, within limits they can provide design to minimize service interruptions in these outlying areas. Second, they can explain why load density in downtown areas permits a higher degree of reliability than can be provided in the outskirts of a city. Third, they can encourage store operators to take measures which will prevent panic and discourage shoplifting in event of a service interruption.

Another concern of mutual interest is economy. Findings of our present survey show there is relatively limited use of higher voltage secondaries. Although such centers apparently offer the ideal opportunity to take advantage of the new 265/460-v system, little use has been made of it. Utilities which have used the higher voltage report worthwhile savings.

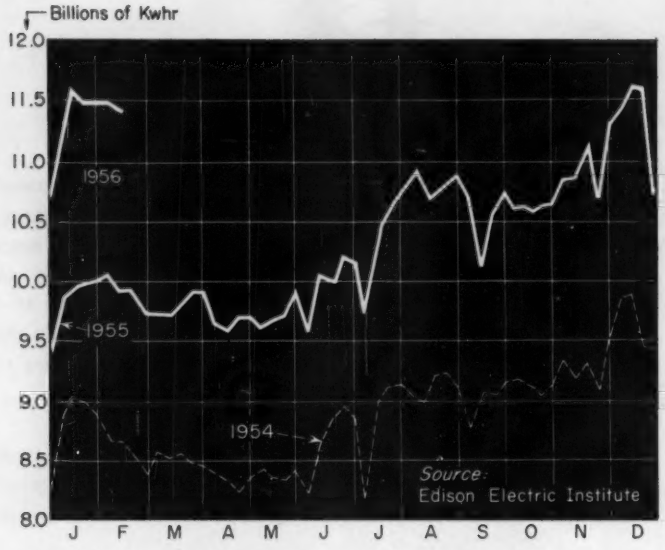
Of course, the problems of adding another voltage to those already in use on a particular system are recognized. It will mean among other things stocking another type of transformer. For the first application this may not be economically justified. But the strength of the shopping center movement indicates that the first will be followed by others. Utilities must consider whether the potential savings will justify the initial expense of the higher voltage.

Third concern is appearance, the primary problem being acceptable overhead facilities. Utilities have a wealth of information on this subject to present to developers while shopping centers are in the early planning stages. This concern can be dealt with most effectively when initial plans are being drawn.

A primary aim of the report is to help utilities present an effective story to developers—a story which will justify the costs necessary for a quality distribution system. Electrical World hopes that the information made available will aid in overcoming the primary concerns arising from the vast growth and spread of shopping centers.

ELECTRICAL WEEK

LAST MINUTE



OUTPUT

Week Ended Feb. 11
11,343,000,000 Kwhr
Up 14.3%

Atomic Energy Commission requirements — 1,125,000,000 kwhr (Electrical World estimate). Excluding AEC, output increase was 9.9%

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Feb. 11	+14.3	+10.5	+8.3	+22.2	+8.4	+11.7	+14.1	+10.0	+21.5	+13.1
Feb. 4	+14.9	+8.9	+7.1	+22.1	+10.8	+14.1	+15.0	+14.4	+21.1	+12.8
Jan. 28	+15.1	+11.0	+8.9	+22.8	+10.2	+13.1	+14.5	+10.2	+17.1	+16.3

Seasonally Adjusted Index 214.2 Week Ago 215.5 Year Ago 187.0

Issue's Highlights—AEC approves Yankee Atomic Electric's plans for 134,000-kw nuclear power plant . . . AEC appraises progress of its peacetime atom program . . . Coal prices seen rising 15 to 50¢ a ton in most of nation . . . TVA plans to finance new steam unit with power revenues, by-passing act on basis of legal interpretation . . . N. Y. Power Authority Chairman Moses threatens to seek FPC approval for state development of Niagara if Congress fails to act this session . . . Line Material will distribute new fiberglass line pole products made by Gar Wood Industries.

Significant Decision—In what could be far-reaching decision if upheld by higher courts, U. S. Judge Peirson Hall, Los Angeles, has ruled that federal government is illegally impounding, at Friant Damon San Joaquin River, water which is property of owners of some 300,000 acres of land below dam. Judge said government has no sovereign title to water in San Joaquin River shed and recognition of such a claim "would, in effect, deprive property owners of their water rights on every stream on which there is a federal dam."

TVA Efficiency—TVA reports new record of efficiency in 1955 for its coal generation in producing 36,909,400 kwhr at average of 9,833 Btu's per kwhr for each 0.82 lb of coal. Fuel cost averaged slightly less than 1.8 mills a kwhr. In 1954 steam plants required 10,234 Btu, or 0.86 lb of coal for each kwhr produced.

Atomic Power—AMF Atomics, Inc, subsidiary of American Machine & Foundry, has announced agreement with Mitchell Engineering, Ltd, of London, England, to build atomic power plants for foreign countries. Plants will be built in British Commonwealth and other countries . . . First British power reactor to be built and owned outside the Atomic Energy Authority has been announced. Of the water-moderated, "swimming pool" type, it will be at the Associated Electrical Industries Research Establishment.

Priest Rapids Bids—Although still unable to reach agreement on power contract with prospective customers, Grant County (Wash.) PUD has invited construction bids for proposed $120-million Priest Rapids hydro project. Bids will be opened March 12.

NEWS OF THE INDUSTRY BRIEFLY TOLD

Washington Wire—Chairman Clinton P. Anderson of Joint Committee on Atomic Energy said last week fears of explosions at private atomic power plants are groundless. AEC has developed almost 100% safe operating procedure, he said . . . About 25 major utility companies and many state utility commissions have asked ICC not to allow 7% freight rate increase for railroads to go into effect Feb. 25 or else to exempt coal from the increase.

Square D Expands—Square D Co plans $9-million expansion program, largest in its history, over next 22 months, according to Pres Gordon Patterson. Firm reports 1955 sales, including Electric Controller & Manufacturing acquired last year of over $80 million, compared with $65 million for combined firms previous year. Earnings for 1955 will be about $5 a share compared with $3.40 in 1954 for Square D alone.

Rate Matters—North Carolina Utilities Commission has approved new special rate schedule for Carolina P&L. Schedule will be for high load factor service involving big industrial customers . . . Commission also approved new water heating rate for Duke Power to make electric water heating more competitive with gas . . . Los Angeles Department of Water is considering $4.8 million (5.9%) a year electric rate increase . . . Eugene (Ore.) Electric and Water Board has announced $330,000 a year electric rate reduction.

Promotion—Preformed Line Products, Cleveland, has elected Albert Bonds, treasurer and one of the founders of firm, vice president in charge of finance.

Westinghouse Strike—Westinghouse Pres Gwilym Price last week rejected fact-finding proposal by Pennsylvania Gov Leader and four other governors. Said Price: "Directors and management of Westinghouse believe that they cannot delegate to outsiders, with no responsibility to company's employees or stockholders, the right to determine the fundamental terms of the union agreement under which Westinghouse must live for some years, and by which its competitive position is affected." Earlier, federal mediators had withdrawn from negotiations following IUE hedging on initial agreement to set aside time study until all other issues are settled and employees back at work. Meanwhile, IUE members back at work exceeded 6,000 in nine plants, nearly 14% of total 44,000 strikers. And IUE has filed unfair labor charge at Baltimore to block hearings on petition of employees there for de-certification.

ABOUT PEOPLE IN THE INDUSTRY

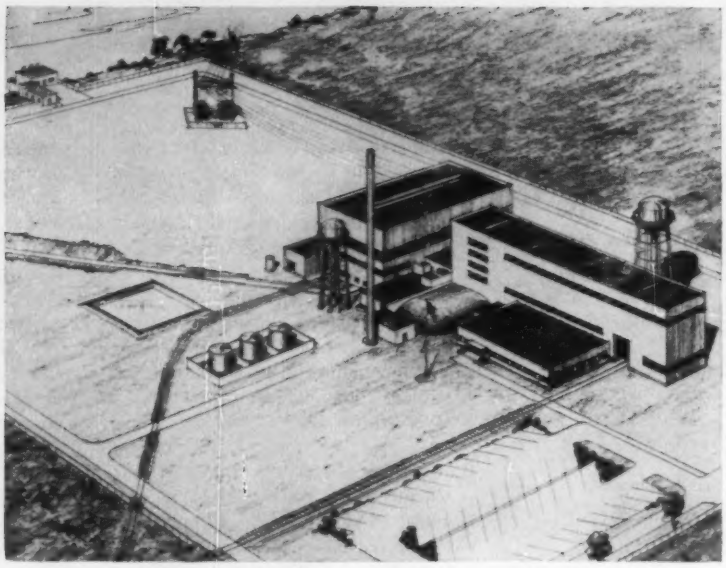
Government's action in repudiating its Dixon-Yates contract obligations is unwarranted, James M. Barry, chairman of executive committee, Southern Co, told New York Security Analysts last week. "We intend to press the litigation vigorously and have every confidence that our position will be sustained. On balance, Dixon-Yates controversy has probably been a good thing in that it has helped give the public a realization of the subsidies and inequities inherent in vast federal power programs," he said.

Formation of new regional electric utility association, The Electric Council of New England (first reported in EW, Jan. 16), has been announced by Sherman R. Knapp, president, Connecticut L&P, and first president of new council. Capt H. A. Ingram will be executive director; H. A. Cadwell, president, Western Massachusetts Electric, vice president; and A. J. McNulty, comptroller, Boston Edison, treasurer. Council, said Knapp, will permit the 48 member companies to exchange information on common problems.

More News About People page 190

12-Utility group proposes nuclear power plant—

Cost: $40 million
Capacity: 134,000 kw
Site: Near Rowe, Mass.
Reactor: Pressurized water
Status: Clears 1st hurdle as . . .



AEC Okays Yankee Atomic Design

Yankee Atomic Electric Co's plan for a $40-million, 134,000-kw pressurized-water nuclear power plant near Rowe, Mass., has been granted preliminary approval by the Atomic Energy Commission.

This means that Yankee can complete planning and engineering for the project, with a good chance of getting substantial government aid.

The Yankee proposal was one of four submitted last year under AEC's large central station power demonstration reactor program.

The New England company's plan was rejected once because it requested a free long-term supply of government-owned nuclear fuel and cut-rate charges for reprocessing the fuel after use. AEC had offered to waive fuel charges for a period of seven years from July 1, 1955, and it refused to extend this.

AEC also offered free use of government laboratories and test facilities, use of AEC consultants, and payments for technical and economic information uncovered during construction and operation of the proposed reactors.

Yankee revamped its whole proposal, brought in Westinghouse Electric Corp to work out a new design. Monsanto Chemical Co, the original Yankee designer, withdrew from the atomic power field altogether.

Westinghouse came up with a design modeled after the PWR which it is building for AEC and Duquesne Light Co at Shippingport, Pa. This differs some from the Duquesne plant. Yankee uses stainless steel instead of aluminum in the reactor core; U-235 enrichment of its uranium oxide fuel is uniform, instead of "spiked;" secondary loop steam pressure is 600 psig, instead of 585 psig; steam temperature is 486F, compared with Shippingport's 540F.

Other characteristics of the Westinghouse-Yankee design:

Thermal output is 500,000 kw. Amount of fuel is higher than the 25,500 kg of natural uranium and the U-235 enrichment is lower than the 2.7% which Monsanto had planned.

(*Continued on page* 102)

AEC Okay 'Gratifying' Says Yankee President

Yankee Atomic Electric Co's Pres William Webster, who is also executive vice president of the New England Electric System, said recently that all 12 companies composing Yankee Atomic Electric Co were gratified with the Atomic Energy Commission's recent approval of Yankee's nuclear power plans (see above).

He explained that Yankee could now go forward with proceedings before other regulatory bodies, work out engineering and construction estimates and other details pursuant to beginning actual construction.

In discussing the cost aspect, Webster recalled that AEC has cautioned "that nuclear power will not immediately provide lower cost power" in relation to that produced by conventional methods.

"Such a statement," he added, "holds true for the Yankee project, and until many of the uncertainties of atomic generation are worked out through research and actual practice, it is doubtful whether any precise figures can be given of power costs from this atomic electric plant."

AEC Report to Congress

Peacetime Atomic Advance Measured

- **Several thousand technical reports declassified for private industry**
- **Designs for at least four large central station power plants approved**
- **Steps taken to insure private facilities; safety regulations established**

The Atomic Energy Commission has presented its yearly report to Congress on progress in peaceful uses of the atom under the 1954 Atomic Energy Act.

In two days of hearings before the Joint Congressional Committee on Atomic Energy, the AEC commissioners last week outlined these great strides in the last 12 months:

- Thousands of technical reports have been thrown open to inspection by industry and the public—enough, says AEC Chairman Lewis Strauss, to enable a private citizen to build an operating nuclear reactor without access to classified data.
- Designs for at least four large central station nuclear power plants have been approved, and proposals are pending on at least ten other power reactors.
- Bilateral agreements providing for power reactor information and materials exchanges have been negotiated with six nations, and a whole new program to enable others to come into the program has been worked out. Machinery to operate the international atomic pool at the core of President Eisenhower's atoms-for-peace plan is being readied.
- Use of radioisotopes by industry and science has been promoted.
- A whole regulatory system to insure safe and practical operation of atomic facilities has been established.
- Steps to insure future supplies of raw materials have been taken.

Many pressures have been brought to bear on AEC to speed peacetime atomic development under the liberalizations of the 1954 act. AEC has resisted some, but in the main its efforts have been in tune with the aims of those demanding action.

This was apparent as the hearings opened. The long-smouldering feud between Joint Committee Chairman Clinton P. Anderson (D-N.M.) and AEC Chairman Lewis Strauss glowed again, but only briefly (EW, Feb. 13, p 7). Two days later, the atmosphere was one of mutual admiration for jobs being well done.

Timing of the hearings coincided with the closing date on AEC's small-scale reactor demonstration program. Seven applicants—three cities, three cooperatives, and one university—submitted designs under this second round in the reactor plan (EW, Feb. 13, p 8).

Cost of Reactor Program

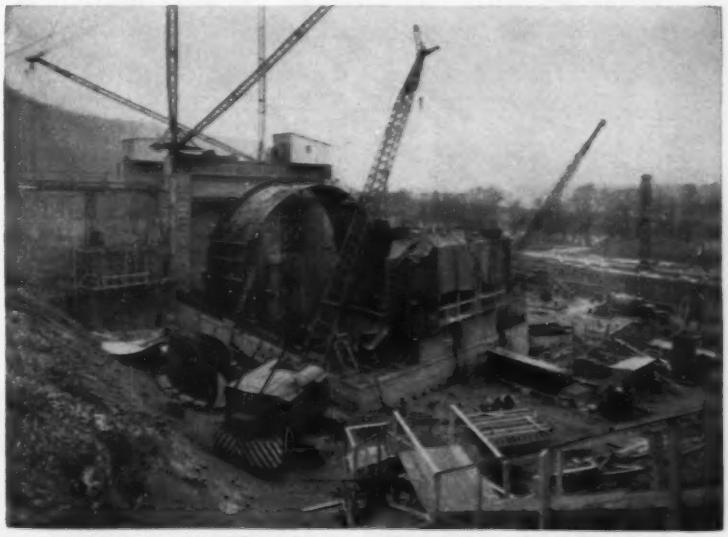
W. Kenneth Davis, chief of the AEC Reactor Division, estimated that the government's experimental reactor program, which includes Duquesne Power & Light Co's 60,000-kw pressurized water plant at Shippingport, Pa., (see photo) and nine smaller experimental facilities, would cost the taxpayers $221.7 million. This includes cost of all work from July 1, 1953, through completion of the projects and involves fabrication of reactor cores, but not cost of special nuclear materials. Davis fixed industry's share of costs for these at $20.2 million—mostly Duquesne's.

To compare, Davis estimated cost of both the large and small-scale demonstration reactor programs at $164.8 million. Of this, he said, the government would pay $54.7 million, while the non-federal applicants would foot a bill of $110.1 million. Costs in this category do not take into account fabrication of cores since AEC has approved private fuel fabrication facilities which should be able to supply the reactors when needed.

As an indication of what the future holds, Davis pointed to the three prospective builders of large plants who have not asked any federal aid—Consolidated Edison Co of New York, Commonwealth Edison Co, and Pennsylvania Power & Light Co. Costs of these three plants are projected at $145 million, with no government money involved.

In Davis's opinion, the variety of reactor concepts represented by these 23 designs is the chief reason why the United States is ahead of the rest of the world in the peacetime atomic race. He sees the diversity of the

(*Continued on page* 102)



PROGRESS AT DUQUESNE LIGHT'S ATOMIC PLANT, SHIPPINGPORT, PA.

Coal Price Up 15-50¢ a Ton

. . . because of 80¢ per day pay boost for miners; producers seek other economies to prepare for future atom power competition

Coal prices continue on the rise despite determined efforts by producers to reduce costs of coal-produced power because of the threat to their market inherent in nuclear power development.

Complicating the producers' economy drive is the 80¢ per day pay boost for miners which goes into effect April 1. As a result of this and other rising expenses, including increased costs of supplies and construction of new mines, prices of bituminous coal will be upped April 1 in most sections of the country.

Price Hike Tallied by Area

Coal companies in the north and Midwest plan price boosts of 15¢ to 50¢ per ton, according to contracts now being negotiated with major customers, and southern producers will up industrial steam coal prices by 15¢.

Major suppliers to eastern utilities in northern West Virginia and central Pennsylvania also plan price increases. West Virginia advances will be about 6%, or 25¢ per ton, and Pennsylvania prices will rise between 35¢ and 50¢, depending on quality.

In Ohio, a rise of 25¢ per ton will be in effect and price boosts in the Midwest will average about 20¢.

One factor contributing to price boosts—the construction of new mines—has come about because of increased demand for coal for electric power generation, steel production, and export.

Meeting Atomic Power Threat

To meet the challenge of the atom to their power market, coal producers are pushing various cost-cutting methods such as mine mechanization, construction of power plants close to mines, reduction in coal freight rates, and development of techniques to squeeze more power out of each pound of coal.

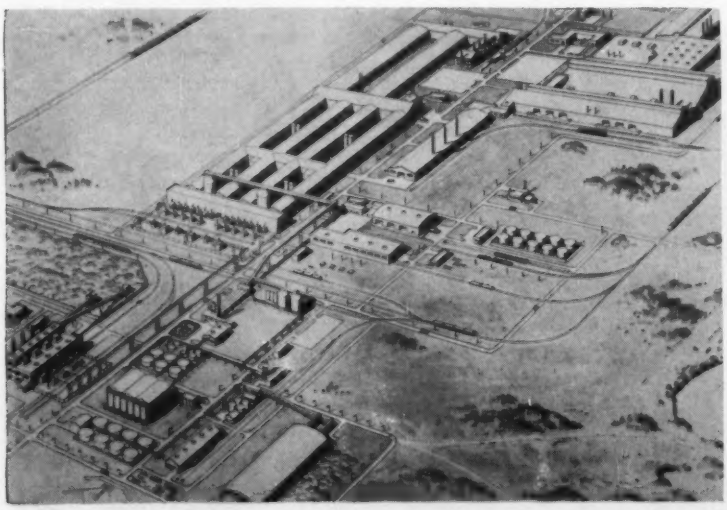
"If we're the target," said Tom Pickett, executive vice president of National Coal Association, "we aim to be a moving one so that when atomic energy does come into the market, we'll be in such a competitive position that it won't capture much."

One of the weapons—low freight costs—has proved effective. Some new plants paying low freight rates can deliver power at only four mills per kwhr, less than half the nine-mill cost of the cheapest electricity expected from future atomic plants. That price is also lower than the seven-mill-plus average cost of coal-produced power to all U. S. industrial customers.

Mechanization of mines, another method, has increased average production per man per day from five tons in 1940 to about 10 tons at present. Increase to 16 tons per man is predicted.

Because rail charges amount to about 40% of the delivered price of coal, coal operators are demanding lower railroad rates, arguing that railroads thus could help hedge against losses which would result if "freightless" atomic fuel overtakes coal's power market.

To avoid high freight costs, the industry is encouraging big power users to construct plants near coal mines or cheap transportation. This is being done by Kaiser Aluminum & Chemical Co, which will use power from a nearby Ohio Power Co plant, and by Olin Mathieson Chemical Corp which, in cooperation with Pittsburgh Consolidation Coal Co and American Gas & Electric Co, plans a power plant near a coal mine in Cresap Bottom, W. Va. (see photo).



COAL-POWERED, fully integrated aluminum operation planned by Olin Mathieson Chemical Corp, American G&E, Pittsburgh Consolidation Coal. Power plant extreme left in above sketch, will be farther north on Ohio River

Electronic 'Brain' Slated for CEI System in 1958

Predicting savings in time, effort, and money, Cleveland Electric Illuminating Co will install an electronic system analyzer to help its engineers solve design problems, cut power outages, and increase operating efficiency.

The alternating current network analyzer, a $150,000 device, will duplicate in miniature the company's 1,700 sq mi system. A maze of 381 circuits, more than 10 miles of wire, and 80 indicating instruments, the analyzer will provide fast answers to questions on capacity and location of future generating stations, lines, substations, and transformers.

The analyzer, a Westinghouse Electric Co product, will be built in an L-shaped lab about the size of a ranch-type home in CEI's downtown offices. It is expected to help engineers forecast emergency results better and restore service quicker than present methods. Installation date has been set for 1958.

TVA Seeks Congress By-pass

. . . in new plan to finance $28-million steam unit with power revenues while bond issuing proposals are being considered

Tennessee Valley Authority is not waiting for Congress to pass judgment on its pending revenue bond proposals; it plans to go ahead with new construction, using power revenues to start a new $28-million unit at John Sevier Steam Plant.

Administration Backs Move

This news of the power agency's move to install new generating capacity while Congress ponders its future came in a supplemental budget request for fiscal 1956. It has the backing of the Eisenhower Administration.

In the fiscal 1957 budget he submitted to Congress last month, President Eisenhower asked Congress to authorize $3.5 million, charged to the 1956 budget, to begin construction of a fourth 180,000-kw steam unit at Sevier. This was a request for a direct appropriation. Eisenhower said he wanted Congress later to authorize TVA to issue revenue bonds to complete this unit as well as to build two new 135,000-kw units at Johnsonville.

Now, Eisenhower's Budget Bureau has approved TVA's twist to utilize net power revenues to begin the Sevier unit. The supplemental 1956 request revealed TVA has already entered into agreements with manufacturers for the new unit, basing its ability to pay the $3.5 million on its power receipts. The Budget Bureau commented that, to suspend work after agency has mailed "letters of intent" to the manufacturers, would leave TVA open to cancellation charges.

Counsel Approves Expenditure

TVA's decision to get the Sevier unit started without waiting for Congress to decide whether its future capacity should be financed through appropriations or revenue bonds grows out of a decision of its general counsel that it can spend power revenues for new generating capacity without specific Congressional authorization.

In 1948, Congress enacted a clause in the government corporation act designed to prevent this. That section reads:

"None of the power revenues of the TVA shall be used for the construction of new power-producing projects (except for replacement purposes) unless and until approved by act of Congress."

TVA's legal counsel takes the view that the word "projects" does not include additional units at existing TVA power plants.

Moses Urges State Plan For Niagara Development

Robert Moses, chairman of New York State Power Authority, has warned Congress that he will attempt construction of the Niagara Power project with or without its permission.

His threat, contained in the authority's annual report, said that if Congress by-passed the measure during the present session, the authority would apply directly to Federal Power Commission for the license.

Because of a reservation in the 1950 treaty between Canada and the U. S., which provides that Congress authorize any power project undertaken on the U. S. side, this action by the authority would result in a court challenge of the reservation's constitutionality.

Sen Herbert H. Lehman, (D-N.Y.) has strongly opposed taking the treaty reservation to court because he feels it would identify him and New York's Gov Averill Harriman with supporters of the controversial Bricker amendment. This amendment proposes to make a treaty invalid as internal law unless it had the same approval Congress gives to internal laws.

The New York State Legislature, meanwhile, has received several bills proposing to limit the activities of the power authority.

Five state agencies, including the power authority and two others headed by Moses, recently protested three of these measures.

One proposes that the authorities file annual reports "in a form prescribed by the State Controller," and that they submit annual budgets to the governor and legislature "in a form . . . prescribed by the Budget Director."

Another would include a provision in all authority bonds authorizing redemption at not more than 105% of par after five years, outstanding.

The last bill proposes that privately negotiated sale of bonds be barred, unless State Controller approves.

Fiberglass Poles Offered

. . . with Line Material chosen as distributor for Gar Wood Industries' new products

Selection of the Line Material Co for the distribution of new fiberglass pole line products for the utility and construction industries was announced last week by E. F. Fisher, president of Gar Wood Industries Inc, Wayne, Mich.

First product of the new line, which has been under development since 1954, will be fiberglass cross arms and pertinent hardware for installation on existing poles. Further products will include fiberglass poles, conduit, highway structures, and several other items.

An experimental installation of the fiberglass utility poles and cross arms is now in service in Michigan where initial duty is reported as favorable. A second experimental installation of 12 poles is to be made in Texas about mid-March, it has been reported.

Gar Wood Industries and Line Material Co will work together in the development of the new product line, according to a joint statement by E. F. Fisher of Gar Wood and R. G. Wheaton, president of Line Material.

According to Fisher, Gar Wood selected Line Material because of its knowledge of the industries involved, its engineering skill, and its sales services. Line Material will enhance its applications of the new line of products by designing and manufacturing suitable hardware for them, it was stated.

Mexico to Get Power From First Steam Jet

Mexico's first industrially usable subterranean steam jet (see photo) was found recently after a six-year search by Federal Electricity Commission and is planned for use in supplying power, as is done in Italy.

Concurrent with the discovery, FEC Director Luis F. de Anda announced plans to begin construction this year on a plant to harness energy from the jet and to place an order for the plant with Ansaldo, S. P., of Genoa, Italy, within the next few weeks.

Location of the well is in the power-short state of Hidalgo, about 80 miles northwest of the industrial section of Mexico City. De Anda mentioned the possibility of bringing electric power to the capital city.

He estimates that the harnessed steam energy will produce 25,000 kw. While a chemical analysis of the steam has not yet been received, it is known that the steam contains sulphur and magnesium.

Height of the plume varies from 400 ft in the cool early morning to 260 ft in the warm mid-day. Temperatures at the bottom of the 785-ft well, which is 22 in. in diameter, vary from 260-300 C. Pressure has been measured at 450 psi.

The well was drilled with a percussion rig mostly through basalt. Just before the steam was reached, the drill bit pierced a sheet of rhyolite. At times during the penetration earth temperature reached 157 C. So that the well may be carried to a depth of 1,500 ft, workmen were instructed to cut off the jet before mid-February.

A "wait-and-see" attitude has been adopted by electric power producers in Mexico because of a number of questions left unanswered in the FEC report on the project. Major factor in the admitted gamble of constructing a geothermal generating plant far from other power generation sources, they feel, is the consistency of the steam and boiling water the geyser will emit after it has been in operation over a longer period.

In addition to FEC, other agencies which sponsored the search were the Bank of Mexico, a governmental institution; and the Nacional Financiera, Mexican reconstruction finance corporation.

POWER BRIEFS

● North Dakota's first hydro power plant began production recently at the Garrison Dam near Riverdale when the first of five generating units went into operation. The $309-million project has been under way for almost 10 years and will eventually give the dam a capacity of 400,000 kw.

● Duke Power Co's capacity will increase 15% to 2.5-million kw when two 175,000-kw units, under construction at Plant Allen near Belmont, N. C., have been installed probably in 1957. Total cost of both units will exceed $41 million. Three more units to be added later will boost Plant Allen capacity over 1-million kw, representing an investment of $100 million.

● Utah Power & Light Co plans to start construction of a 100,000-kw, $15 million generating plant either late this year or early in 1957.

● Georgia Power & Light Co has purchased a 100-acre site on the Altamaha River near Jesup for construction of a 75,000-kw plant at a cost of over $10 million.

● Omaha Public Power District has authorized construction of a third generating unit of 100,000 kw at North Omaha power station. The $16.5-million unit is to be completed in 1959. Now under construction is the 100,000-kw Unit No. 2, scheduled for completion by May, 1956.

● Carolina Power & Light Co's planned $40.5-million expenditure for new construction in the next two years includes completion of the 135,000-kw generating units near Moncure and construction of a 168,750-kw unit scheduled for completion in 1958.

● A $93.6-million program for development between now and 1983 of additional dams and power plants along the Mokelumne River is planned by East Bay Municipal Utility District, Calif. Proposed plan includes construction of Camanche Dam, with a 7,500-kw power plant; Middle Bar Dam, with a 15,000-kw plant; Railroad Flat Dam; and enlargement of Pardee Dam and power plant.

Sales Problems Set for EEI Meet Discussion

. . . with load promotion, wiring, space heating, other topics on agenda for annual conference to open March 26 in Chicago

Load building promotion, wiring, space heating, and maintaining the net return—some of the industry's most pressing sales problems—will get serious discussion next month in Chicago at Edison Electric Institute's Annual Sales Conference.

Speakers, just announced by EEI's Commercial Division, include Harllee Branch, Jr., the institute's president; Gwilym Price, president, Westinghouse Electric Corp; W. V. O'Brien, vice president, General Electric Co; J. W. McAfee, president, Union Electric Co of Missouri; Elmer L. Lindseth, president, Cleveland Electric Illuminating Co; Edwin Vennard, EEI's newly-appointed vice president and managing director; and Fischer S. Black, publisher and editor, Electrical World.

The institute's new million-dollar-plus "Housepower" wiring program will be presented by E. O. George, Detroit Edison Co.

Viewpoints from outside the industry will be expressed by Harold H. Young of the New York investment firm, Eastman, Dillon & Co, and Frank W. Lovejoy, Socony-Mobile Oil Co, Inc.

A record-breaking crowd of more than 1,000 utility sales executives is expected to attend the four-day meet at the Edgewater Beach Hotel. It is set to open Monday, March 26 with all-day meetings of EEI's 22 Commercial Division committees.

Tuesday will be devoted to residential, farm, industrial, and commercial group sessions, with the general sessions scheduled to begin on Wednesday and run through Thursday noon.

Special luncheons will be sponsored by the farm group and Public Utilities Advertising Association on Tuesday, and the Prize Awards Committee on Wednesday. A general luncheon will close the conference on Thursday. Speaker at the farm luncheon will be Herbert Pike, an Iowa farmer and a member of the American farm delegation which toured the Soviet Union last summer.

O. R. Doerr, chairman of the EEI Commercial Division Executive Committee and vice president of Pacific Gas & Electric Co, will preside at the conference.

NEWS BRIEFS

CP&L wheels dam power—With formal Washington approval Carolina Power & Light Co began wheeling 20,600 kw from John H. Kerr dam to 13 rural electric cooperatives (EW, Dec. 19, p 8). Serving 70,230 members in 38 eastern North Carolina counties, co-ops are paying about 6.8 to 7.02 mills per kwhr compared to former 7.5 mills. Savings of approximately $500,000 are expected by the co-ops during term of the ten-year contract.

Argonne lab head quits—Dr Walter H. Zinn, director of the Argonne National Laboratory in Lemont, Ill., since 1946, resigned effective June 30 reportedly because Atomic Energy Commission's contract for large research particle accelerator was awarded to Midwest Universities Research Association instead of Argonne.

AEC ok's reactor facility—A Babcock & Wilcox Co critical experiment facility for studies of nuclear reactor core tests has been authorized by Atomic Energy Commission. Located at B&W's fuel element fabrication plant, Lynchburg, Va., the facility will be completed in April and will permit nuclear characteristics tests of full scale atomic reactor without high heat intensities.

Memphis Debates Plant Bonds—City officials, local bank representatives, and Rudolph Smutny of Salomon Bros & Hutzler, New York financial firm, are conferring on plans for marketing $130 million in revenue bonds to build municipal power plant in Memphis, Tenn.

PP&L studies by-product wood uses—With service area covering heavily timbered parts of Washington, Oregon, Idaho, Montana, and Wyoming, Pacific Power & Light Co has prepared 56-page report on manufacture of wood composition board from waste cuts of western softwoods. The economic research study describes characteristics, uses, and manufacturing processes of timber by-products traditionally used as boiler fuel for mill power production.

Utility workers get pay boost—Pay increase of 3.45% has been awarded Pennsylvania Power Co employees represented by Utility Workers Union of America by the arbitration panel selected by the two groups. The increase in base hourly rates, effective Sept. 3, 1955, was the same percentage offered by the company during negotiations that preceded a 17-day strike last fall.

Japan's power deficiency—Continued deficiency in peak capability for Japan was forecast in Sixth Semi-Annual Electric Power Survey. The shortage, estimated at 502,000 kw for the December 1955 peak, is expected to grow to 18.2% of the country's peak load by 1960. Total Japanese capability of 8,723,000 kw in December 1955 will increase about 1,752,000 kw in next five years. The committee anticipates an average annual peak load increase of 7.8% to a 12,806,000-kw total in 1960. Last year's peak was 9,225,000 kw. Privately-owned plants with 17% of nation's capacity were not included.

CES forms Utilities Division—Cleveland Engineering Society has organized a Utilities Division to help meet the need for diversified discussion on overall activities in the northeastern Ohio utility field. The new division, the society's twelfth, will cover specialized interests not within the scope of existing organizations, said Warren H. Chase, president of the society and vice president of Ohio Bell Telephone Co. Temporary chairman of the division is Clarence J. Beller, vice president of electrical operation and engineering, Cleveland Electric Illuminating Co.

Yankee Atomic's 134,000-kw Design Okayed

(*Continued from page* 96)

Reactor temperature and pressure are higher than the 400F and 900 psig proposed by Monsanto.

Reactor cost will run $16 million, compared with $19.3 million under Monsanto's design and the $37.7 million earmarked at Shippingport. Turbo-generator costs will hit $10,010,000, compared with $6.7 million under the Monsanto plan and the $10 million at Shippingport. Land, substation step-ups, start-up, and testing will add another $14,490,000 to the Yankee bill. The government will pay about $7.5 million of this, and Yankee will pick up the tab for $33,423,000, according to present estimates. Per-kw capital investment will come to $300 using the Westinghouse design; this compares with $230 per kw using Monsanto's and the $630 per kw at Shippingport.

Besides obtaining AEC approval of its revised design, Yankee's 12 sponsors have also had their financial plans approved by the Securities & Exchange Commission. Initial financing calls for issuance of $500,000 in capital stock and $500,000 in unsecured, non-interest promissory notes to the sponsoring companies. Two of the companies have been granted special exemption by SEC to prevent them from being classified as holding companies because of the joint venture.

The 12 sponsoring companies are: New England Power Co; Connecticut Light & Power Co; Boston Edison Co; Central Maine Power Co; Hartford Electric Light Co; Connecticut Power Co; Western Massachusetts Electric Co; Public Service Co of New Hampshire; Montaup Electric Co; New Bedford Gas & Edison Light Co; Cambridge Electric Light Co; and Central Vermont Public Service Corp.

Yankee's new design was submitted to AEC last August 22 and plans call for completion in 1959 or 1960.

AEC Reports to Congress on Peacetime Atom Advance

(*Continued from page* 97)

American program as the best way to work toward development of cheap nuclear power, and he believes the British, for instance, will fall behind.

"The British are ahead of us on gas-cooled reactors," Davis admits. But, he adds, "They are passing up other approaches with equally as much promise."

According to Davis' list, the 23 reactors, when built, would be capable of at least 975,000 kw. And this does not take into account the small amounts of unharnessed thermal output at some of AEC's experimental facilities.

Secrecy Guard Lowered

Until 1954, AEC had only two categories of information: Secret and unclassified. That year, Congress directed formation of an industrial participation program which carried with it limited access to classified data.

AEC set up its access agreements program, permitting representatives of industrial concerns to obtain restricted information and extending other aids in their search for knowledge of reactor processes.

The access agreements program has made available to most interested investors the information they need to determine whether they want to get into the program, and the technology with which to implement a positive decision on this score. From the more than 16,000 reports already declassified, a private citizen could construct an operating pressurized water reactor, although it would not be the latest word in design or performance.

But controls inherent in the access agreements program prohibit the free flow of information to all segments of the public which some members of Congress and industry would like. So it has been constantly harrassed, particularly by Anderson and recently by the McKinney panel on the impact of atomic energy (EW, Feb. 6, p 60).

AEC has just completed a hasty review of more than 25,000 reports. It completely declassified about 9,000, placed 6,500 in the confidential category, and retained about 10,000 in the secret file.

The agency is again reviewing its declassification guide which is the operating policy governing atomic secrecy agreed on by the U.S., Britain, and Canada. It is hoped the other nations will agree to further loosening up of the rules.

Insurance Steps Taken

An AEC insurance study team has been investigating the probability and extent of atomic hazards.

Although their study is not yet complete, they have determined that stock casualty companies are willing to underwrite $50 million against public liability damages for each facility. Stock fire companies will write $50 million on plant damages on each facility. And mutual casualty companies will advance $10 million against public liability at each plant.

The big question, now that the insurance men have taken steps toward providing against risks, is whether the amounts available will be enough.

During the hearings, AEC indicated these funds would be enough, at least, to obviate the need for a government insurance program. AEC and the joint committee have both been reluctant to set up a federal program, unless absolutely necessary, and the McKinney panel agreed.

Harold Price, head of AEC's civilian application division, termed the insurance companies' estimates "substantial", and pointed out they far exceed offerings on any other industrial facilities. Chemical companies, perhaps the riskiest of industrial clients for insurance companies, qualify for no more than about $10 million from each insurance company.

CORRECTION

Through inadvertence an error was made in listing the author of the article "Right Conductor Saves Money" in the January 9 issue p 70. Author of this article is H. M. Bankus, Apparatus Division, General Electric Co.

Drop Power Transformer BIL 2 Steps

SYSTEM ENGINEERING
Design

Introduction of new knowledge permits further decreases in insulation levels of power units on systems 138 kv and above

J. R. MEADOR, Manager, Power Transformer Advance Product Engineering, General Electric Co, Pittsfield, Mass.

New knowledge of switching-surge and transformer oil characteristics makes it feasible today to take advantage of recent improvements and to reduce further the insulation levels of power transformers. Results of an investigation over several years confirm this view, and upon them are based the following recommendations:

1. Proper consideration of the factors involved permits insulation reductions of "two classes" for transformers on many systems of 138 kv and above. But this does not apply to transformer phase-to-phase insulation or to bushings.

2. Further studies of switching surges and industry agreement on typical wave shapes are essential to taking full advantage of modern protective equipment.

3. A more accurate method of evaluating the dielectric strength of oil must supersede the present ASTM gap.

Impulse Test Set Up

Common practice 30 years ago was to insulate high-voltage transformers, with neutrals grounded, for 2.73 times phase voltage. Field failures, largely because of lightning, brought adoption of higher insulation levels until, in the early 1930's, the low-frequency test most generally used was 3.46 times phase or twice line-to-line voltage.

After cooperative studies by power companies and transformer manufacturers successfully identified the lightning problem, rapid progress was made in protective systems, particularly in lightning arresters; and the impulse strength of transformers was radically improved. Establishment of an impulse test for transformers by AIEE afforded a gage for making future progress.

Insulation Tests Reduced

As soon as protective levels and insulation strength could be determined with reasonable accuracy, apparatus improvements made insulation level reductions possible. A few power companies began using transformers with the insulation tests reduced one level; that is, 138-kv transformers were insulated for 115 kv. This was fairly general practice about 1950 when further possible reductions became apparent. Under certain conditions, 825-kv BIL was agreed upon for 230-kv transformers. In effect this was a reduction of 1½ classes (full insulation, 1,050-kv BIL; one class down, 900-kv BIL). At about this time 1,175-kv BIL was selected for a new 330-kv system, another 1½-class reduction. As a matter of interest, the low-frequency tests for these latest levels are quite close to 2.73 times phase voltage.

Further reductions in insulation levels, the industry generally agreed, required a better understanding of switching surges and the switching-surge and steady-state strengths of transformers. For many years lightning and impulse voltage had been the criteria for selection of insulation. But recent improvements in lightning arresters changed this.

Prefer Own Methods

Discussion in industry committees has shown that various groups prefer their own ways of calculating transformer-lightning arrester coordination on impulse voltages. Fortunately, each method's final answer is about the same.

Table I is based on the author's usual calculation procedure. It shows how well a modern station-type lightning arrester protects transformers with insulation reduced two steps when the arrester has a rating of 75% of the maximum line-to-line voltage.

From these figures it is obvious that impulse voltages are no longer the criterion for selecting insulation levels. The margin between protective level and BIL is considerably greater than that normally found to be satisfactory in the past. (A corollary of this is that it should now be possible to introduce simplifications in transformer impulse testing procedures.)

Other Factors Studied

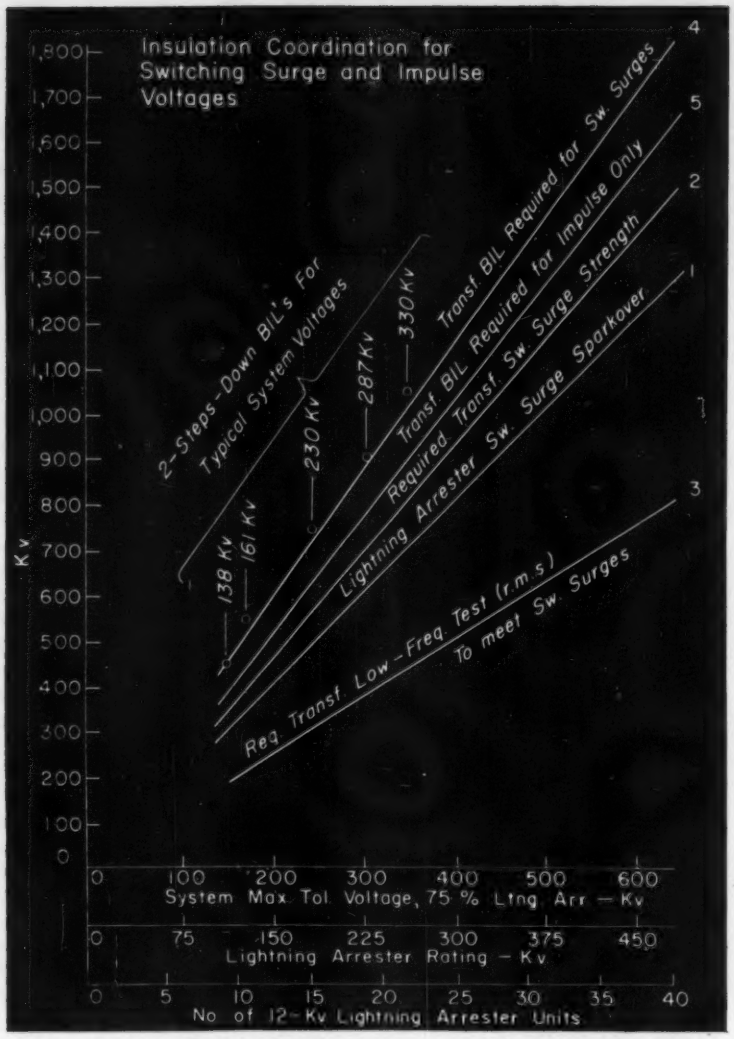
When development of a vastly improved lightning arrester became obvious some five years ago, the author and his associates turned their attention to other factors affecting transformer insulation levels. An important one was switching surges as arrester improvements did not extend to the switching surge protective level.

Studies with the transient analyzer on simulated systems and circuit breaker test data made clear that the number of switching surge wave shapes could be almost infinite. A

TABLE I—Lightning Arrester Protection

Nominal System Voltage (Kv)	Maximum Tolerable Voltage (Kv)	Two Steps-Down BIL (Kv)	Protective Level of Lightning Arrester (Kv)
138	145	450	315
161	169	550	385
230	242	750	520
287	302	900	655
330	347	1,050	760

Note: Lightning arrester values are for rating of 75% of Maximum Tolerable Voltage, using GE Catalog maximum values for IR of 10,000 amp.



CURVE 1—LIGHTNING ARRESTER SWITCHING surge sparkover = 32.5-kv crest × no. of 12-kv units. Curve 2—Required transformer switching surge strength = 15% above Curve 1. Curve 3—Low-frequency test to meet switching surge = Curve 2 ÷ (1.3 × √2). Curve 4—Transformer BIL required for switching surges = low-frequency test × ASA test ratio of BIL to low-frequency test. Curve 5—Transformer BIL for impulse only = max. IR for surge of 10,000 amp + 20%

large number of insulation tests in oil were made with voltage waves ranging up to 100,000 microsec in duration. These showed that a single voltage wave, rising to crest value in 500 to 2,000 microsec, had many attributes of a typical severe switching surge. On this basis, a wave with 1,000-microsec front was "standardized" for development test purposes.

Tests, using impulse voltages, switching surges, and low-frequency voltages, were made on typical insulation structures used in transformers. As expected, these tests showed that switching surges behave more like low-frequency voltage on some structures, and more like impulse voltages on others.

The important conclusion was that when the structure was designed to pass both the ASA impulse test and the 1-min, low-frequency test, the switching surge strength was always at least 30% higher than the crest of the low-frequency test.

Switching surge coordination curves in the accompanying illustration are based on the following:

1. Use of lightning arresters having a maximum switching surge gap sparkover of 32.5 kv crest times the number of 12-kv units (See Curve 1).

2. Transformer switching surge strength should be at least 15% greater than the arrester gap sparkover. This is a justifiable reduction from the 20% margin normally used for impulse voltage protection as two variables are virtually eliminated. Wave shape and surge current magnitude must be considered when determining impulse voltage protection obtained with lightning arresters, but both of these can be neglected when considering switching surges (See Curve 2).

3. Transformer switching surge withstand-strength is 1.3 times the crest of the transformer low-frequency test (See Curve 3).

4. Required transformer BIL is the required low-frequency test times the normal ASA test ratio between BIL and low-frequency test (See Curve 4).

Oil Strength Studied

Points plotted in the chart correspond to what are normally considered two classes down. All lie above the required BIL curves. Table II shows points picked for typical system voltages.

Extensive, detailed study of the dielectric strength of oil has brought to light these important facts:

1. Moisture and other contaminating influences in the oil may reduce the low-frequency strength of many transformer components at least to half (except for sharp-edged electrodes). The same degree of contamination has a minor effect on impulse strength or switching surge strength, using the wave described earlier in this article.

2. ASTM gap tests on oil do not reflect realistically these changes in strength.

3. A more uniform field gap (not having the sharp edges of the ASTM gap electrodes), with provision for circulating the oil through the gap, measures the effect of contaminants with reasonable accuracy.

Conclusions Drawn

These facts lead to two important conclusions:

1. In the past the margin between operating voltage and low-frequency test voltage was large enough so that the ASTM gap, even with its limitations, was adequate as a measure of oil strength because it detected gross

contamination such as free suspended water.

2. The trend to small dimensions in transformers has been accomplished partly by improving the dielectric field conditions. Furthermore, the need to eliminate corona has required the transformer designer to avoid the use of sharp-edged electrodes in regions of high dielectric stress. As the effect of oil contamination is substantially higher in uniform than in non-uniform fields, a more uniform field gap for measuring the oil is necessary.

These conclusions mean that transformer users should be aware of a limiting ratio of operating to test voltage, while taking steps to provide a more accurate method of evaluating the dielectric strength of oil in service.

The EEI-NEMA "Preferred Voltage Ratings for A-C Systems and Equipment" (EEI Publication No. R-6, NEMA Publication No. 117) contains a section on "System Voltages." Its importance in connection with this article lies in the discussion of voltage spread on systems. A portion of the section reads as follows:

"It is recognized that during switching, sudden loss of load, and the like, the voltage may rise momentarily above the normal operating voltages. Usually there is no provision for these contingencies other than the factor of safety required by the test specifications."

Apparatus Endangered

It appears that transformer users are approaching the use of insulation levels that require consideration of these factors. To date the attempt to establish maximum operating voltages for high-voltage transformers has lacked the impetus of a well-documented need. It is now possible to visualize a situation where the need is obvious, such as in the following example:

230-kv system, line-to-ground voltage = 133 kv

750-kv BIL (two steps down), transformer low-frequency test = 325 kv

Transformer oil contaminated to ½ value (assumed to be equivalent to reduction in transformer low-frequency test strength to 162.5 kv).

Step-up transformer at full load, 105% voltage on primary. If the load is dropped, the potential on the high-voltage side of the transformer may increase for several seconds or a minute to 20 to 30% over normal (possibly reaching 160 to 170 kv). If so, the strength and the stress are about equal, and the apparatus evidently is in danger.

TABLE II—Insulation Coordination Based on Use of 75% Arrester

Nominal System Voltage (Kv)	Maximum Tolerable Voltage (Kv)	Two-Steps Down BIL (Kv)	BIL Required for Switching Surges (Kv)	BIL Required for Impulse Only (Kv)
138	145	450	450	380
161	169	550	515	465
230	242	750	710	625
330	347	1,050	1,030	915

Note: Bushing BIL's should not be less than those now used for each system voltage.

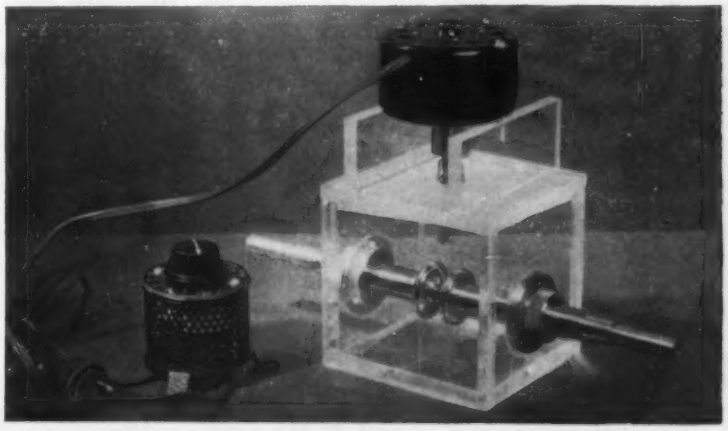
Oil Maintenance Important

It is evident that when insulation is further reduced, not only must dynamic voltage be controlled, but oil maintenance increases greatly in importance.

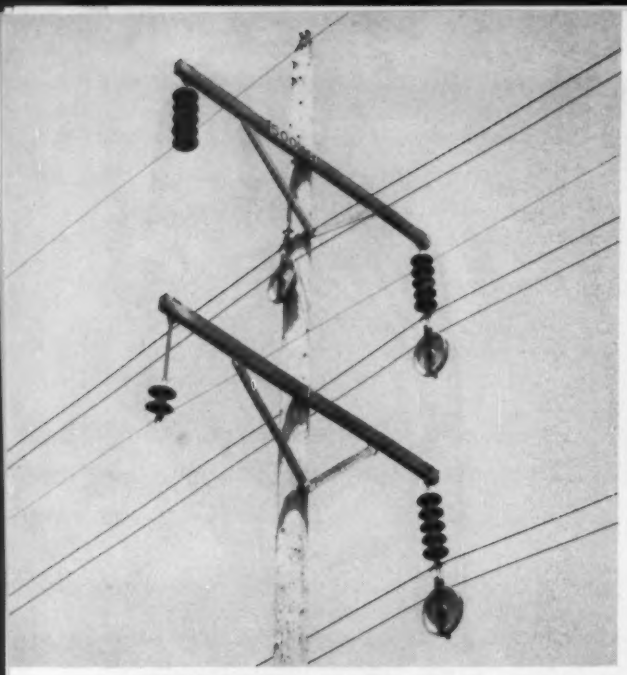
A recent survey of oil from GE transformers in service, tested with a uniform field-type gap used for several years at Pittsfield, indicates that the oil in modern power transformers remains in excellent condition. While oil content per lb of transformer has been substantially decreased, better materials are being used, factory drying processes are more effective, and oil preservation systems have been improved. Thus it is believed that the institution of more rigid controls on the dielectric strength of oil will not be burdensome.

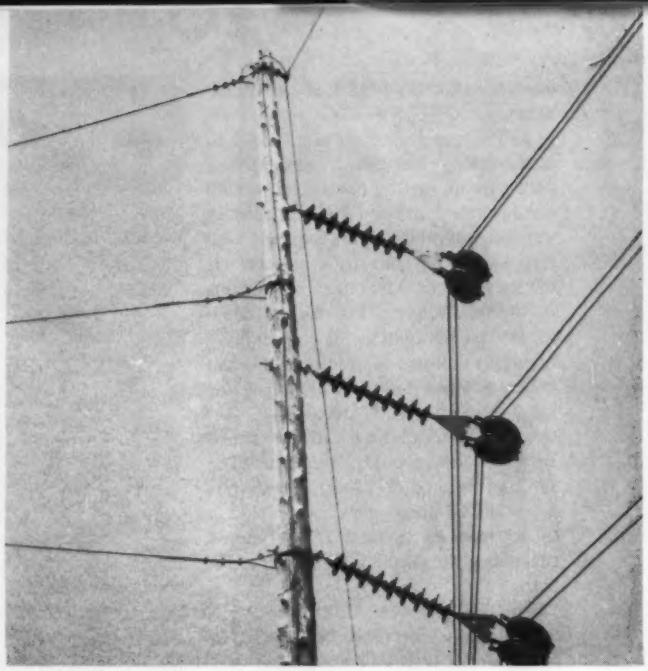
Twelve large power transformers for 138 and 230-kv systems have been built with insulation levels reduced two classes. Shipped in 1951 and 1952, they have operated successfully. Special care was taken to insulate these transformers for two-class reduction so that their operating experience would be truly representative.

Further studies and field experience will show how broadly the recommendations at the beginning of this article can be applied. In general, it is believed that successful use of lightning arresters rated 75% of maximum line-to-line voltage demonstrates a control of system voltage that is adequate for the use of two-steps-down transformer insulation. Obviously the lightning arrester protective level must meet the insulation coordination requirements of the chart.



UNIFORM-FIELD GAP oil testing cell, used in recent studies, has modified hemispheric electrodes and a motor-driven agitator to keep samples in circulation





TWO EXAMPLES OF INSTALLATIONS MADE BY DELAWARE POWER & LIGHT CO ARE SHOWN IN PICTURES ABOVE

Conductor Bundling Proves Best Way

TRANSMISSION
Construction

Delaware P&L Co adopts this method after studies show that it is most economical. Old 4/0 copper cable used on part of job

E. R. STREED, Chief Engineer, Delaware Power & Light Co, Wilmington, Delaware

By using bundled conductor construction on half of an existing 67-kv transmission line, Delaware Power & Light Co has been able to increase the line capacity 100%. Existing No. 4/0 copper cable on part of this line was used as the second conductor in the bundled section, and new 795-MCM ACSR conductor was used to replace this copper wire.

Several possible arrangements were studied. They indicated that bundling was the most economical.

Line Half Copper, Half Aluminum

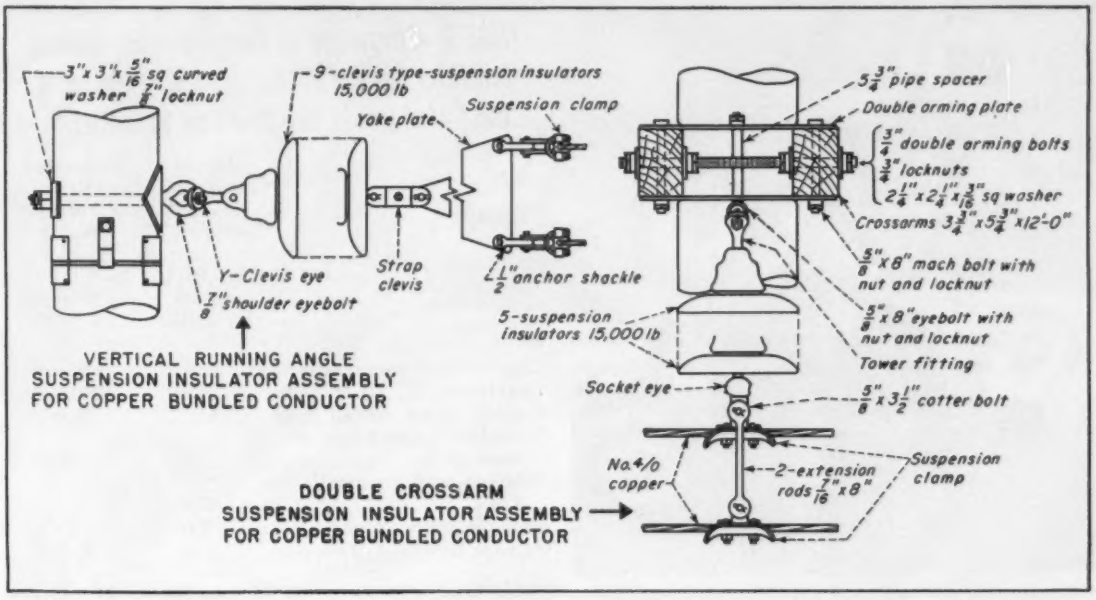
Circuit that was bundled is part of a system tie between the Northern and Southern Divisions of the company. Particular section involved is between Basin Road Substation and Delaney Substation, a distance of 34 miles. The circuit was built in 1945 with No. 4/0 copper wire on a single woodpole line. Voltage drop limited circuit rated capacity to 25 Mw. To meet expanding system transmission needs, it was desired to increase capacity to 50 Mw. Route of line is approximately one-half on private property right-of-way and one-half along public highways.

Studies were made to determine conductor required to enable this transmission circuit to carry 50 Mw within the voltage drop limitation. These showed that 500-MCM copper conductors or 795-MCM ACSR conductors would be required. This was determined from calculations of voltage drop at various lagging and leading power factor loads. It also showed that it would be possible to utilize the No. 4/0 copper in parallel for one-half of the distance and install 795-MCM ACSR conductor for the remaining part of the circuit and obtain the desired capacity.

Horizontal Bundling Not Feasible

Conductor bundling was confined to line sections with suspension insulator type of construction because a vertical bundling arrangement would not be possible where line post construction existed. Span lengths averaged about 325 ft, with maximum length 390 ft. Poles are Cedar, Class No. 3 for tangent structures and Class No. 2 for corner and deadend structures. Bundling of conductors in horizontal plane was not feasible because of decreased clearances which would result between phases and to pole and guys. Installation was made using a vertical arrangement with 8-in. separation. Because spans are less than 400 ft, mid-span separators were not used. This decision was based on sag calculations for various loading conditions and also on experience reported by others who have made bundled conductor installations.

Conductor was suspended by means of a standard suspension clamp hung below the existing conductor clamp using two $\frac{7}{16}$x8-in. extension rods. These rods are fas-


3"x3"x 5/16" sq curved washer
7/8" locknut
9-clevis type-suspension insulators 15,000 lb
Yoke plate
Suspension clamp
5 3/4" pipe spacer
Double orming plate
3/4" double orming bolts
3/4" locknuts
2 1/4" x 2 1/4" x 3/16" sq washer
Crossarms 3 3/4" x 5 3/4" x 12'-0"
Y-Clevis eye
Strap clevis
1/2" anchor shackle
7/8" shoulder eyebolt
5/8" x 8" mach bolt with nut and locknut
5/8" x 8" eyebolt with nut and locknut
5-suspension insulators 15,000 lb
Tower fitting
Socket eye
5/8" x 3 1/2" cotter bolt
No. 4/0 copper
2-extension rods 7/16" x 8"
Suspension clamp
VERTICAL RUNNING ANGLE SUSPENSION INSULATOR ASSEMBLY FOR COPPER BUNDLED CONDUCTOR
DOUBLE CROSSARM SUSPENSION INSULATOR ASSEMBLY FOR COPPER BUNDLED CONDUCTOR

DRAWINGS SHOW DETAILS OF VERTICAL ANGLE AND DOUBLE CROSSARM SUSPENSION INSULATOR ASSEMBLIES

to Raise Transmission Line Capacity

tened to the clamp holding top conductor by the same bolt which holds the socket eye attachment to the insulator string, the existing cotter bolt being replaced with a ⅝x3½-in. bolt.

On heavy corner and dead-end construction a triangular steel yoke plate was used, one end of which was attached to the insulator string by means of a strap clevis. The two conductors were attached to the corners of the other end of the yoke plate by ½-in. anchor shackles. To prevent the conductors from rotating in position, the existing ball and socket type insulators were replaced with clevis type insulators.

Both Conductors Have Same Sag

Conductor bundled was No. 4/0, 12-strand, hard-drawn copper, ultimate strength 9,438 lb. Area is in heavy loading district. Original conductor was installed in 1945 with a tension based on one-half ultimate strength or 4,740 lb at zero degrees, ½-in. ice, and 8-lb wind. Before installing second conductor the existing No. 4/0 wire was placed in sheaves and the tension adjusted to that calculated to result in 4,020-lb maximum final tension. Second No. 4/0 conductor was pulled in with same sag. Reduction in tension from one-half ultimate per conductor was done to lessen loading on poles and guy on corners and deadends.

In this particular installation the two conductors had both been subjected to same loading experience and could be assumed to have same sag characteristics. This made installation easier than it would have been to pull in a new conductor with one that had been subjected to uncertain loading conditions.

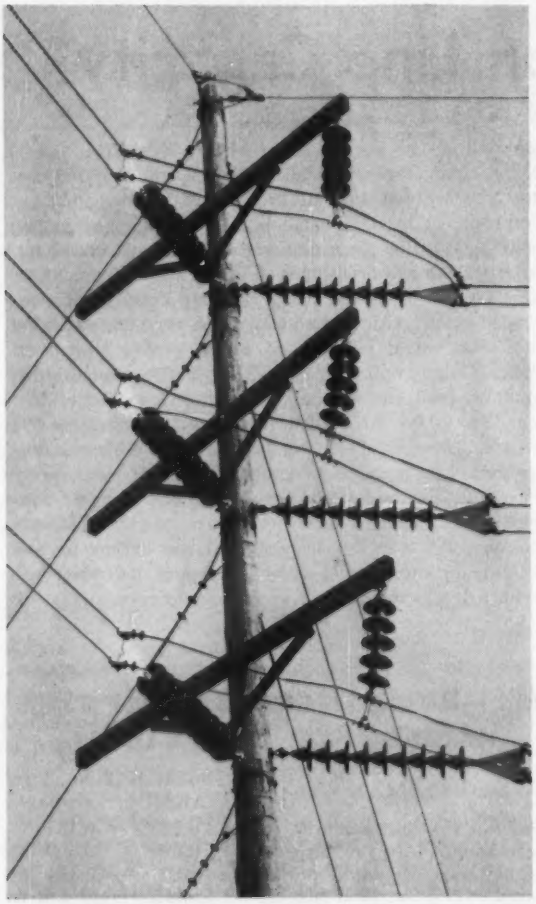
The No. 4/0 wire to be used for bundling was first removed from line sections where 795-MCM (18/1) ACSR conductor was installed. Actually the No. 4/0 conductor was used to pull in the 795-MCM conductor. Power-driven reels mounted on a truck supplied pulling power and at the same time reeled up the old conductor. After tension had been adjusted on the No. 4/0 conductor which was to be left in place, stringing sheaves were suspended below existing conductor using the same extension rods that would be used to attach second suspension clamp. Only variation in this was in sections where a distribution conductor was suspended from one end of bottom arm. Where this existed, the No. 4/0 wire for the 67-kv circuit was pulled in along the pole and lifted out to arm position after sagging in order to permit work being done with distribution conductor energized. Bundled conductor was pulled to somewhat higher than design initial tension and left in the sheaves under this tension for approximately one day in order to remove the effects of reeling. It was then sagged to the same tension as that of

TABLE I—Conductor Characteristics Are Similar in Single and Bundle-Conductor Portions of the Line

	795 MCM ACSR	2-No. 4/0 Copper
Resistance, Ohms per mile (50C)	0.1288	0.1515
Reactance, Ohms per mile.....	0.699	0.569
Capacitance, Megohms per mile.	0.165	0.134

Based on 8-in. vertical spacing for bundled conductors
Equivalent phase spacing, 11.9 ft.

POWER-DRIVEN truck-mounted reels supplied pulling power and at the same time reeled in the No. 4/0 copper conductor



BUNDLED INSTALLATIONS at the angle structures used both types of connection devices. Mid-span separators are not used

TABLE II—Comparison of Costs—Bundling Existing Conductor One-Half of Line and New Conductor or One-Half of Line vs New Conductor on Entire Line

Item	Actual Cost Bundle No. 4/0 Copper 17 miles. Install 795 MCM ACSR 17 miles	Estimated Cost Remove & Salvage No. 4/0 Copper. Install 795 MCM ACSR 34 miles
Right-of-way easements....	$2,475	$2,500
Install new 795 MCM ACSR	124,310	250,000
Replace poles, install guys.	14,725	15,000
Straighten poles, brace crossarms	14,890	15,000
Remove and re-install No. 4/0	47,680	—
Remove poles, wire.....	2,080	20,000
Salvage credit—4/0 copper.	—	—85,000
Total Cost	$206,160	$217,500

the existing conductor and clipped into the clamps.

Two types of construction were used on the original line. Post type insulators on 10½-ft crossarms were used on sections along roads through housing communities and along a particularly winding road to avoid excessive overhang of private property. Suspension insulators with 12-ft crossarms were used on private property right-of-way and along rural highways. Two horizontal crossarms are used, two phases of the 67-kv circuit being attached to the top arm, and the third phase from one end position of the bottom arm. For a portion of the line the other end of the bottom arm is used to support one phase of a 4,160-v or 7,200-v local distribution circuit. Entire line is protected by a 3-No. 6 copper-clad static wire which is also used for the neutral conductor of distribution circuit.

Cost Comparison Given in Table Above

The approximate cost of pulling out and reinstalling the No. 4/0 copper wire in bundled arrangement was $2,800 per mile. This is exclusive of cost incurred in a few pole replacements and some additional guying. Comparison of actual cost of completed job of bundling the No. 4/0 copper conductor on one half of the line and installing new 795-MCM ACSR conductor on the other one half with an estimate of cost to remove and salvage No. 4/0 copper conductor and install new 795-MCM ACSR conductor on entire line is given in Table II.

Bundled Construction Trouble Free

Construction was performed by Day & Zimmerman, Inc. Transmission circuit has given good performance, and no difficulty has been found on bundled construction. Although no ice loading has as yet been experienced, trouble from this is not anticipated. Success of this construction indicates that no particular problems in equalizing sags will be experienced if conductors with similar service history are used.

SHOPPING CENTERS (NO. 81) BY TAKING DOWNTOWN LOAD INTO SUBURBS ARE COMPLICATING DISTRIBUTION PROBLEMS

Electrical World Industry Report on . . .

Shopping Center Distribution

DISTRIBUTION
Design

Survey of 124 centers served by 50 utilities reveals problems were met chiefly by standard practices. Overhead used on 76%

EDWARD ALLEN, Midwestern Editor

While shopping centers have presented special problems to the distribution engineer, the problems, in general, have been solved by modifying standard practices rather than by the development of special measures. This was revealed by Electrical World's survey of 124 shopping centers served by 50 utilities.

Shopping centers covered in the survey were chosen largely on the basis that they were in outlying areas, provided off-street parking, and were large enough to be important in their particular community. Such developments are outside normal underground areas and usually offer no desirable place for pole lines. In many instances developers have been reluctant to pay the difference in cost between overhead and underground construction. Utilities have hesitated both because of cost and of the problem of discrimination between

OVERHEAD DISTRIBUTION, MAINLY BECAUSE IT IS CHEAPEST, IS MOST POPULAR. IT IS USED IN OVER 75% OF CENTERS

SHOPPING CENTER DISTRIBUTION continued

these and their other customers.

The nature of these developments makes service continuity of unusual importance. Yet developers have apparently not recognized the need for emergency service to the extent that they are willing to pay for duplicate or loop feed or for other special measures to assure service continuity. Utilities have, in most instances, not assumed the responsibility because of the added cost and the problem of discrimination.

For these reasons the survey shows that 94 (76%) of the 124 centers covered in the survey have all or a part of the primary distribution system overhead. Of these, 89 have some or all open wire primaries while 7 have aerial cable. Thirty seven, or 30%, have some primaries overhead and some underground.

Underground primary distribution was provided in full or in part for 67, or 54% of the centers. There were only six installations, 5% of the total and 9% of the underground jobs, using buried cable. The underground primaries were installed in ducts on 58 jobs, 87% of the underground jobs. Whether installations were in ducts or were buried cable was not indicated on several jobs. PILC cables were used on 43 of the 67 underground jobs while on ten the insulation was rubber or rubber-like. Cables on six jobs had Neoprene jackets.

Blackout Prevention Unusual

Willingness of large stores to pay the cost of underground facilities and unwillingness of smaller stores to pay such costs were apparently the reason for the many cases where a part of the facilities were underground and part overhead. Some, however, are accounted for by the installation of overhead facilities to a lateral pole in the shopping center area and the running of underground from there to the vaults in the buildings. Study of figures shows that no special provisions were made to prevent total blackout of the shopping center in 75 cases, 60.4% of the total. At seven of the centers, large stores provided their own emergency lighting.

Network service was supplied to two centers while four were served from a primary network. Ten centers were provided with duplicate primary feed, and at 11 centers there were looped primaries. At two centers the primaries were looped through the secondaries.

However, analysis of the replies to the questionnaire showed that some type of duplicate primary supply is available at 28 centers and that looped primaries supply 33 centers.

Underground facilities for 43 centers and lines in the rear in 34 cases were the chief precautions taken for public safety from high voltage wires. It was evident that relays were depended upon in numerous cases. Where poles were set in areas of heavy auto or pedestrian traffic, they were protected by curbs or concrete islands.

Primary voltage was in the 11 to 13-kv class for 68, or 55% of the shopping centers covered. The 4-kv class was next with 41 jobs, followed by 4,800 v which was used on 13 jobs.

Service to four shopping centers was at 34.5-kv. The choice of 34.5-kv primary voltage was prompted by proximity of these lines to the shopping centers to be served and the size of the load.

The primary voltage chosen was standard in the area in 89 cases (72%), and readily available, also indicating that it was standard in the area, in 16 cases (13%).

Types of transformer installations varied widely. As in the case of primaries, and in about the same ratio, centers had both overhead and vault-type transformer installations. Pole-type installations were made on 43 jobs, 38% of the total. Transformers were installed on platforms

Center No. ?

Center No.'s in story refer to centers listed in 8-page table beginning on page 116.

OFF-STREET PARKING IS THE ONE COMMON DENOMINATOR OF SHOPPING CENTERS; OTHERWISE THEY VARY GREATLY

on poles at 39 centers, 31%. Ground-type installations were made on 19 jobs, 15%.

Transformers were installed in vaults on 66 of the jobs, 53% of the centers covered in the survey. The customer furnished the vaults on 62 of these projects, and the utility on ten. As indicated by these figures, some vaults were furnished by the utility and some by the customer on six projects. Locations of the vaults were the chief reason for the division, with the utility furnishing those in the streets and alleys and the customer those in buildings on private property.

Some Roof Transformers

Transformers were installed on building roofs at three of the shopping center projects, served by two of the utilities reporting. This required additional strength in building steel but cost less than standard vault installations and overcame objections to overhead installations. Two utilities used surface type vaults.

Single-phase transformers were installed for 75 or 60% of the centers while 3-phase transformers were used on 31 jobs, 25%. On 14 jobs some of each were used. Most common secondary voltage for shopping centers is 120/208. This is used, exclusively or in combination with others, for 95, or 76% of the centers. The 120/240-v secondaries were found at 33, or 26.6%. Sixteen centers, 13%, used 480 or 240/480 v, but this was apparently used for power purposes.

Only six shopping centers on three utility systems were using 265/460 or 277/480 v with stepdown transformers for equipment requiring lower voltage. This voltage is being offered by 14 utilities, 28% of those covered in the survey.

Two utilities furnish these stepdown transformers, one conditionally. Other utilities offering the voltage require customers to furnish step-down transformers.

Some overhead secondary construction is used for 58 of the centers, 47% of the total. Secondaries are all or partially underground at 63 centers, 51%. Ten centers had some overhead and some underground secondaries.

In numerous cases secondaries actually consisted only of services. In the case of underground construction customers frequently brought services to the meter room or vault. Where there was overhead construction, there were frequently transformers on every pole, no secondaries, and services from the transformer pole to the building.

Where there were secondaries, they were often very heavy to accommodate the loads involved. They ranged in size up to 500 MCM and even 1,000 MCM. Secondary lengths ranged from the service-only type up to 600 ft. Six shopping centers had aerial cable type secondaries to some degree. At ten there were spot networks, and one had a true network located in a very concentrated area.

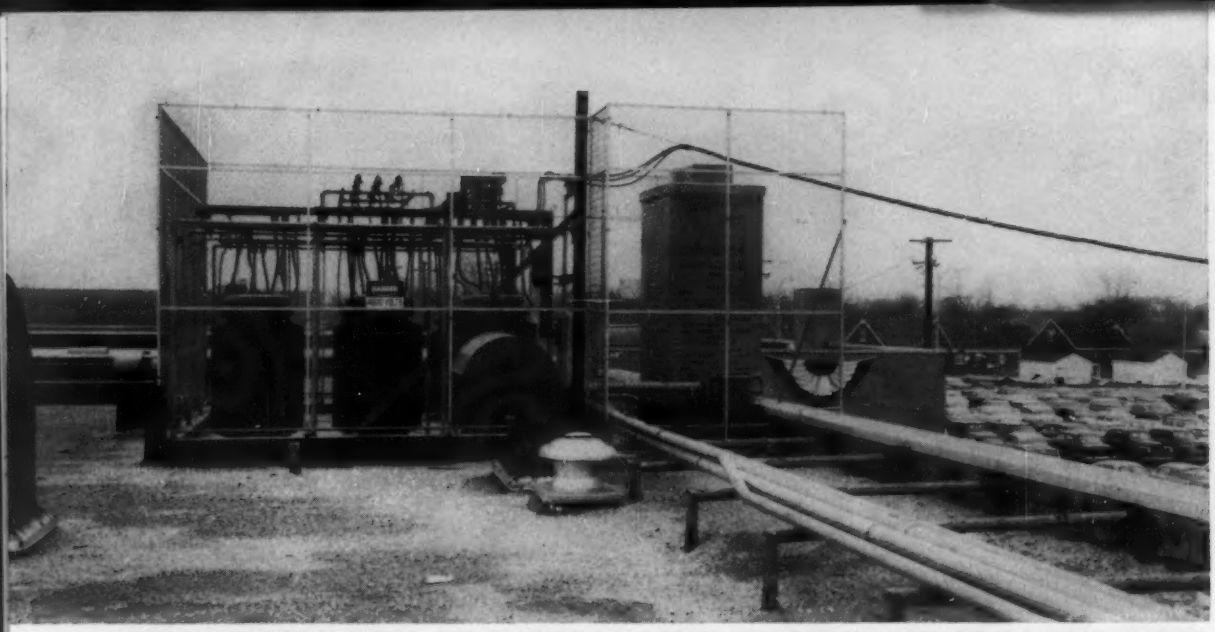
Parking area lighting is predominantly multiple, 110 centers (89%); and underground, 118 centers (95%). Voltage at 94 centers (76%) is in the 120/208, 120, or 120/240-v class with only 9 centers (7.25%) reporting street lighting at 265/460 or 480 v.

Nearly all, 107 or 86.5%, of the shopping centers covered in the survey have meters for individual customers. Twelve centers are master metered, and five have some individual meters while some buildings in the center are master metered.

Table I—Companies Offering 265/460 or 277/480-V Service*

Company	Minimum Load at Which Offered
A	50 kw
B	600 kw
E	150 kw
G	300 kva
M	Customer choice
O	600 kw
Q	Customer request
W	300 kw
AA	300 hp
AH	Customer choice
AI	1,000 kw
AJ	500 kw
AK	100 kw
AQ	1,000 kva
AW	Offered

* Usually at user's option and expense



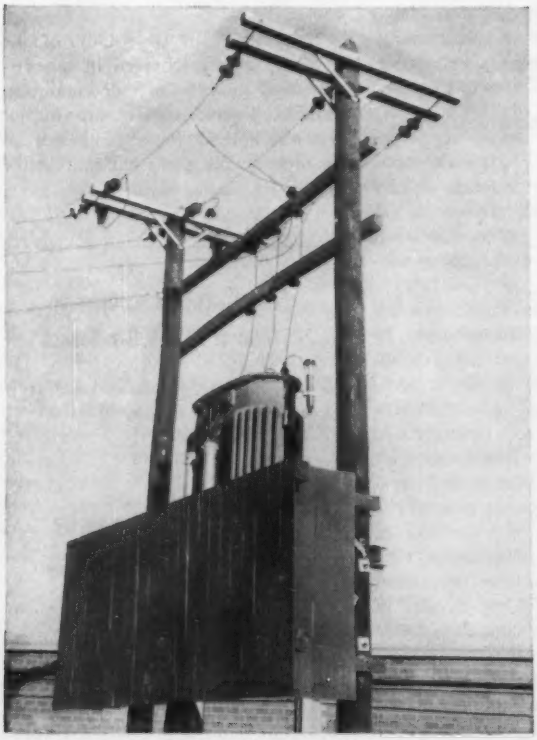
ROOF-TYPE JOBS WERE USED FOR THREE CENTERS BY TWO UTILITIES. HERE WIRING IS BROUGHT TO SIX 167-KVA UNITS

SHOPPING CENTER DISTRIBUTION continued

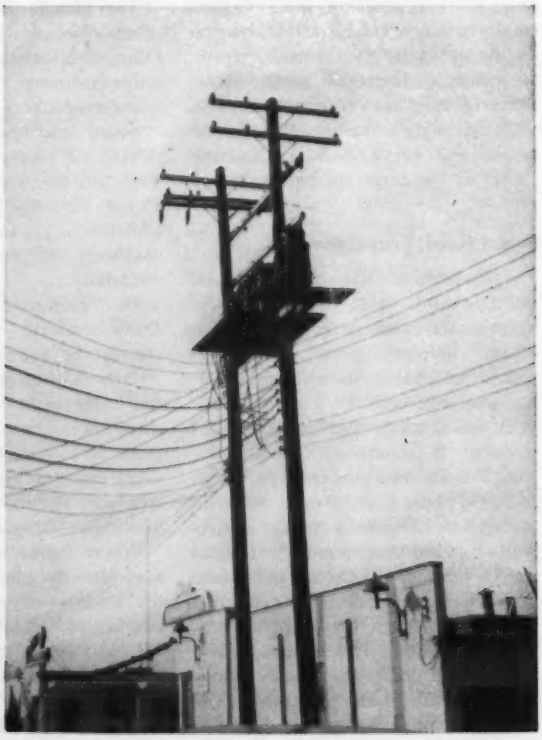
Transformer Installations Vary

Based on a survey of 124 shopping centers, several significant observations may be made on the location and mounting of transformers in such centers:

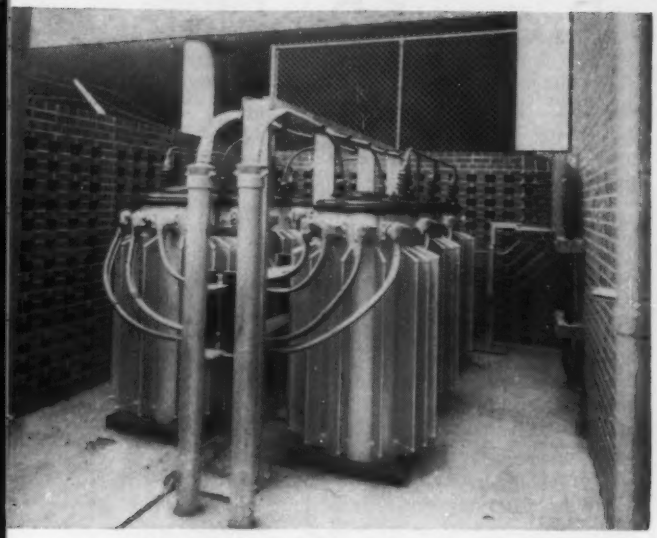
1. Conventional installations were made on 43 jobs, 38%, with cluster mountings popular; pole-platform installations were made on 39 jobs, 31%; ground-type installa-



SHIELDED PLATFORM ON POLES (Center No. 84) provides improved appearance and prevents contact with the equipment



TRANSFORMERS were installed on pole platforms at 39 centers, 31% of the total. Here is a power and lighting bank



GROUND-LEVEL vault (Center No. 83) with open-type brick enclosure hides transformers without stopping ventilation

VAULT built along underground truck passage serves Center No. 78. Secondary is run in bus duct to the metering board

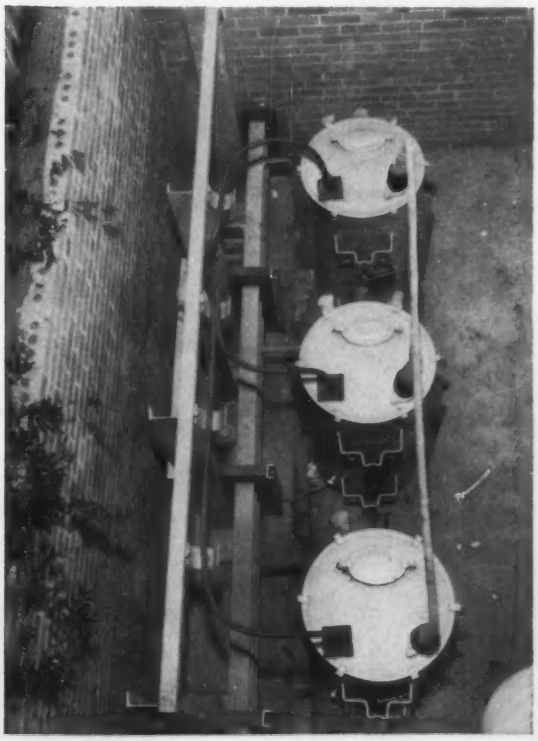
tions were made on 19 jobs, 15%; and vault installations were made on 66 jobs, 53%.

2. Three centers had transformers on roof platforms. These are out of the way and out of sight. They cost less than conventional underground vaults.

3. Efforts to improve appearances were evident.

4. Economy was the motive behind many practices. Utilities felt that they could spend no more than the cost of conventional overhead without being charged with discrimination between customers. Developers didn't want to pay distribution costs.

5. Protection of the public was mandatory.



GROUND LEVEL VAULT (Center No. 82) has brick enclosure on two sides, cyclone fence on third, and building on fourth

GROUND LEVEL VAULT (Center No. 77) has wooden fence with barbed wire top and conforms to center's building style

Services Present Problems

Handling of overhead services places utilities in a dilemma.

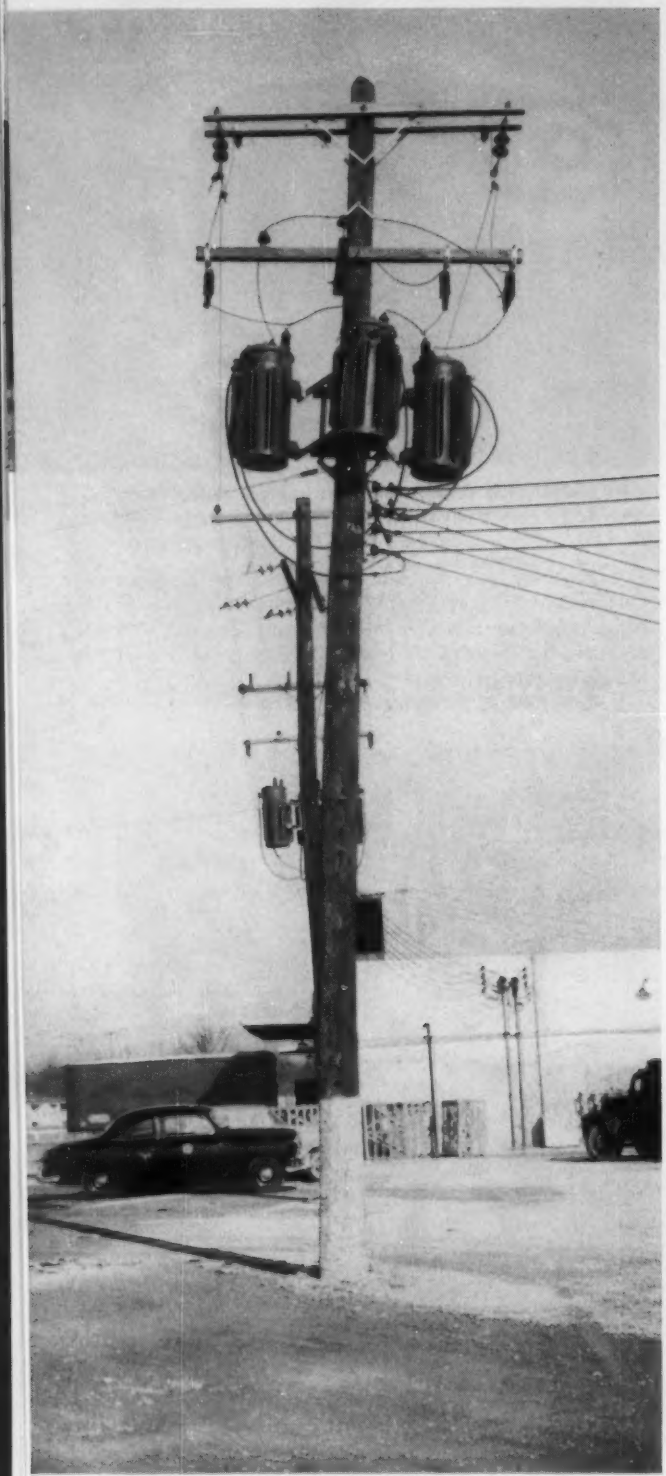
1. Many heavy conductors are required to serve the loads of large shopping centers. Poles are pulled out of line because there is no place to install anchors and guys.

2. Where conductors span alleys or driveways, it is difficult to secure the proper clearance.

3. Poles set close to buildings eliminate clearance problems but prevent trucks and cranes from approaching the buildings to load or unload.

4. Strong columns on buildings sometimes help solve the problem by raising the building end of the services. Bracing or guys are sometimes used to support attachments above the level of the roof. Where attachments have to be made at or below roof level of single story buildings in order to get sufficient strength for their support, clearance is insufficient. Sag reduces clearance still more.

Multiplex service cables help solve these problems. Often these are run from ground-level transformer installations close to the buildings directly to them.



LONG HEAVY SERVICES pull poles out of line. Poles cannot be guyed because there is no room to install any anchors

HEAVY COLUMN raises building end of service to provide adequate clearance for service over driveways and alleys

POLES CLOSE TO BUILDINGS create problems for trucks handling heavy equipment like that on roof of Center No. 16

FOLES ACROSS DRIVEWAYS present problem of clearance for trucks. Low buildings demand low installation of services

MULTIPLEX SERVICE CABLES make neat installations with adequate clearance for trucks. Where cables are extended along wall, number of services can be reduced adding to advantages of this type of installation (Center No. 97)

SHOPPING CENTER DISTRIBUTION continued

SHOPPING CENTER No.	1	2	3	4	5	6	7
UTILITY SERVING	A	A	A	A	B	B	B
Connected load	3,000 kva	2,000 kva	.....	.....	.....	2,800 kw	4,050 kw
Demand	2,500 kva	1,800 kva	1,500 kva	10,000 kw	3,000 kw	2,375 kw	3,600 kw
Air conditioning	Yes	Yes	Yes	4,000 hp	1,200 kw	1,000 kw	1,200 kw
PRIMARIES							
Voltage, kv	4.8	4.8	4.8	4.8	4.16	4.16	12
Overhead	Yes	Yes	Yes	No	No	No	Yes
Open wire	Yes	Yes	No	.....	.....	.....	No
Aerial cable	Yes	No	Yes	.....	.....	.....	Yes
Underground	Yes	Yes	No	Yes	Yes	Yes	No
TYPE PRIMARY FEED							
Radial	.....	No	.....	No	.....	No	No
Duplicate	.....	No	.....	Yes	Yes	Yes	No
Automatic throwover	.....	.....	.....	Yes	No	Yes	.....
Manual throwover	.....	.....	.....	.....	Yes	No	.....
Loop	Yes	Yes	Yes	.....	.....	No	Yes
SECONDARIES							
Voltage	120/208	120/240; 120/208	120/208	120/208; 480	120/208	480; 120/240	480; 120/208
Overhead	Yes	Yes	.....	No	No	No	Yes
Open wire	Yes	Yes	.....	.....	.....	.....	Yes
Aerial cable	No	No	.....	.....	.....	.....	No
Underground	No	Yes	Yes	Yes	Yes	Yes	Yes
TRANSFORMERS							
Type installation							
Pole	Yes	Yes	No	No	No	No	No
Platform on poles	No	No	No	No	No	No	Yes
Ground level	No	No	No	No	No	Yes	Yes
Platform on roof	Yes	No	Yes	No	No	No	No
Vault	Yes	Yes	No	Yes	Yes	Yes	Yes
Furnished by utility	No	No	.....	No	Yes	No	No
Furnished by customer	Yes	Yes	.....	Yes	No	Yes	Yes
Sizes, kva	37½ to 750	50 to 250	100; 167	500; 750; 1,000	500	333; 500	250; 666
Single or 3 phase	Single	Single	Single	3	3	Single	Single
METERING							
Master	No	No	No	Yes	No	No	No
Individual customer	Yes	Yes	Yes	No	Yes	Yes	Yes
PARKING AREA LIGHTING							
Multiple	Yes	No	Yes	Yes	No	Yes	Yes
Voltage	120/208	.....	208	208	.....	120/208	120/208
Series	No	Yes	No	No	Yes	No	.....
Underground	Yes	No	Yes	Yes	Yes	Yes	Yes

SHOPPING CENTER No.	13	14	15	16	17	18	19
UTILITY SERVING	C	C	C	C	D	D	D
Connected load	3,000 kw	1,200 kw	3,600 kw	1,600 kw	.....	7,500 kva	4,000 kva
Demand	1,500 kw	600 kw	1,800 kw	800 kw	800 kw	4,500 kva	3,000 kva
Air conditioning	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PRIMARIES							
Voltage, kv	13.2	13.2	13.2	13.2	4.16	34.4/4.16	4.16
Overhead	Yes	Yes	Yes	Yes	Yes	Yes	No
Open wire	Yes	Yes	Yes	Yes	Yes	.....	.....
Aerial cable	No	No	No	No	No	.....	.....
Underground	No	No	No	No	Yes	Yes	Yes
TYPE PRIMARY FEED							
Radial	Yes	Yes	Yes	Yes	Yes	No	No
Duplicate	.....	.....	.....	.....	.....	Yes	Yes
Automatic throwover	.....	.....	.....	.....	.....	Yes	No
Manual throwover	.....	.....	.....	.....	.....	No	Yes
Loop	.....	.....	.....	.....	.....	No	No
SECONDARIES							
Voltage	120/208	120/240; 240	120/208	120/240; 240	120/240; 120/208	4,160-120/208; 480	120/208
Overhead	Yes	Yes	Yes	Yes	Yes	No	No
Open wire	Yes	Yes	Yes	Yes	Yes	.....	.....
Aerial cable	No	No	No	No	No	.....	.....
Underground	No	No	No	No	No	Yes	Yes
TRANSFORMERS							
Type installation							
Pole	Yes	Yes	Yes	Yes	Yes	No	No
Platform on poles	No	No	No	No	No	No	No
Ground level	No	No	Yes	No	No	No	No
Platform on roof	No	No	No	No	No	No	No
Vault	No	No	No	No	No	Yes	Yes
Furnished by utility	None	None	None	None	.....	No	No
Furnished by customer	.....	.....	.....	.....	.....	Yes	Yes
Sizes, kva	25 to 100	10 to 100	15 to 750	25 to 100	50 to 150	112½ to 1,500	25; 500; 750
Single or 3 phase	Single	Single	Both	Single	Both	3	Both
METERING							
Master	No	No	No	No	No	Yes	Yes
Individual customer	Yes	Yes	Yes	Yes	Yes	No	No
PARKINGAREA LIGHTING							
Multiple	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voltage	208; 240	240	208	240	120/240; 120/208	120/208	120/240
Series	No	No	No	No	No	No	No
Underground	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Shopping Center Distribution Practices of 50 Electric Utility Systems

8	9	10	11	12
B	B	B	C	C
.....	11,000 kw	2,835 kw	4,000 kw	3,400 kw
4,138 kw	9,050 kw	2,400 kw	2,000 kw	1,700 kw
1,360 kw	3,500 kw	800 kw	Yes	Yes
34.5	12	12	13.2	13.2
No	No	Yes	Yes	Yes
.....	.....	No	Yes	Yes
.....	.....	Yes	No	No
Yes	Yes	No	No	No
No	No	No	Yes	Yes
No	Yes	Yes	.....	.....
.....	Yes	No	.....	.....
.....	.....	Yes	.....	.....
Yes	.....	.....	.....	.....
277/480	120/208, 480	120/208	120/208, 120/240	120/208
No	No	Yes	Yes	Yes
.....	.....	Yes	Yes	Yes
.....	.....	No	No	No
Yes	Yes	.....	No	No
No	No	No	No	No
No	No	No	No	No
No	No	No	No	No
No	No	No	No	No
Yes	Yes	No	No	No
Yes	3	.....	None	None
No	2	.....	.....	.....
1,000	750, 2,500	167½, 250	10 to 100	15 to 100
3	3	Single	Single	Single
No	No	No	No	No
Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes
277/480	480	120/208	208, 240	208
No	No	No	No	No
Yes	Yes	Yes	Yes	Yes

20	21	22	23	24	25	26	27	28
E	E	E	E	F	F	F	F	G
750 kva	700 kva	500 kva	.....	1,225 kw	1,645 kw	2,100 kw	3,000 kw	.....
650 kva	600 kva	450 kva	600 kva	1,112 kw	1,228 kw	1,500 kw	2,150 kw	1,250 kw
Yes	Yes	Yes	Yes	448 tons	534 tons	700 tons	1,000 tons	500 hp
12.5	12.5	4.16	12.5	13.2	13.2	13.2	13.2	12.5
Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes
Yes	Yes	Yes	Yes	Yes	.....	Yes	.....	Yes
No	No	No	No	No	.....	No	.....	No
No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
No	No	No	No	No	No	No	No	No
120/240	120/208	120/240, 120/208	265/460	120/208, 120/240	120/208	120/208	120/208, 480	120/208
Yes	Yes	No	Yes	Yes	No	Yes	No	No
Yes	Yes	.....	.....	.....	.....	.....	.....	.....
No	.....	.....	Yes	.....	.....	.....	.....	.....
No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
Yes	Yes	No	No	Yes	No	Yes	No	No
No	No	No	No	Yes	No	No	No	No
No	No	No	No	No	No	No	No	No
No	No	Yes	No	Yes	Yes	Yes	Yes	Yes
.....	.....	No	.....	No	No	No	No	No
.....	.....	Yes	.....	Yes	Yes	Yes	Yes	Yes
37½ to 100	15 to 100	50, 75	250	50 to 167	50 to 333	50 to 150	167, 250, 500	50, 500, 750
Single	Single	Single	Single	Single	Single	Single	Single	Both
Yes	No	No	No	Yes	Yes	Yes	No	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
120/240	120/208	120/240	265/460	120/208	120/208	120/208	480	120/208
No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SHOPPING CENTER DISTRIBUTION continued

SHOPPING CENTER No.	29	30	31	32	33	34	35
UTILITY SERVING	G	G	G	H	H	I	J
Connected load	.....	.....	.....	490 kw	420 kw	1,500 kva	650 kw
Demand	1,685 kw	800 kw	2,000 kva	160 kw	300 kw	760 kva	400 kw
Air conditioning	690 hp	400 hp	Yes	80 kw	160 kw	Yes	232 hp
PRIMARIES							
Voltage, kv	12.5	13.2	12.5	4.16	4.16	11	13.2
Overhead	Yes	No	Yes	Yes	Yes	No	Yes
Open wire	Yes	.....	Yes	Yes	Yes	.....	Yes
Aerial cable	No	.....	No	No	No	.....	No
Underground	Yes	Yes	Yes	No	No	Yes	No
TYPE PRIMARY FEED							
Radial:	Yes	Yes	Yes	Yes	Yes	No	No
Duplicate	No	No	No	No	No	Yes	No
Automatic throwover	.....	.....	.....	.....	.....	Yes	.....
Manual throwover	.....	.....	.....	.....	.....	No	.....
Loop	No	No	No	No	No	No	Yes
SECONDARIES							
Voltage	120/208	120/208	120/208	120/240	120/208; 120/240	120/208; 460	120/208
Overhead	Yes	No	No	Yes	Yes	No	Yes
Open wire	Yes	.....	.....	Yes	Yes	.....	Yes
Aerial cable	No	.....	.....	No	.....	.....	.....
Underground	Yes	Yes	Yes	No	No	Yes	No
TRANSFORMERS							
Type installation							
Pole	Yes	No	No	Yes	Yes	No	Yes
Platform on poles	No	No	No	No	Yes	No	.....
Ground level	No	No	No	No	No	No	.....
Platform on roof	No	No	No	No	No	No	.....
Vault	Yes	Yes	Yes	No	No	Yes	.....
Furnished by utility	No	No	No	.....	.....	No	.....
Furnished by customer	Yes	Yes	Yes	.....	.....	Yes	.....
Sizes, kva	100; 167; 750	1,000	500	15 to 37½	25 to 75	1,000	.....
Single or 3 phase	Both	3	3	Single	Single	3	.....
METERING							
Master	No	Yes	No	No	No	No	No
Individual customer	Yes	No	Yes	Yes	Yes	Yes	Yes
PARKING AREA LIGHTING							
Multiple	Yes	Yes	Yes	Yes	Yes	Yes	.....
Voltage	120/208	120/208	120/208	120	120	.....	.....
Series	No	No	No	No	No	No	.....
Underground	Yes	Yes	Yes	Yes	Yes	Yes	.....

SHOPPING CENTER No.	45	46	47	48	49	50	51
UTILITY SERVING	L	L	L	L	M	M	M
Connected load	600 kva	650 kva	800 kva	350 kva	.....	570 kva	1,000 kva
Demand	450 kva	500 kva	750 kva	325 kva	1,200 kw	450 kw	750 kva
Air conditioning	100 kva	100 kva	150 kva	150 kva	Yes	Yes	Yes
PRIMARIES							
Voltage, kv	4.16	4.16	4.16	4.16	4.16	4.16	12.5
Overhead	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Open wire	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aerial cable	No	No	No	No	No	No	No
Underground	No	No	No	No	No	No	No
TYPE PRIMARY FEED							
Radial	No	No	No	No	Yes	No	No
Duplicate	No	No	No	No	No	No	No
Automatic throwover	.....	.....	.....	.....	.....	.....	.....
Manual throwover	.....	.....	.....	.....	.....	.....	.....
Loop	No	No	No	No	No	Yes	Yes
SECONDARIES							
Voltage	120/240; 240	120/240; 240	120/240; 240	120/240; 240	120/208	120/208; 120/240	120/208
Overhead	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Open wire	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Aerial cable	.....	.....	.....	.....	.....	No	.....
Underground	No	No	No	No	No	No	No
TRANSFORMERS							
Type installation							
Pole	Yes	Yes	Yes	Yes	No	Yes	No
Platform on poles	Yes	Yes	Yes	No	Yes	No	Yes
Ground level	No	No	No	No	No	No	No
Platform on roof	No	No	No	No	No	No	No
Vault	No	No	Yes	No	No	No	No
Furnished by utility	.....	.....	No	.....	.....	.....	.....
Furnished by customer	.....	.....	Yes	.....	.....	.....	.....
Sizes, kva	.....	.....	75; 100	50; 75; 100	100	37½; 50; 75	50; 75
Single or 3 phase	.....	Single	Single	Single	Single	Single	Single
METERING							
Master	No	No	No	No	No	No	No
Individual customer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PARKING AREA LIGHTING							
Multiple	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voltage	120/240	120/240	120/240	120/240	120/208	120	120/208
Series	No	No	No	No	No	No	No
Underground	Yes	.....	.....	Yes	Yes	Yes	Yes

36	37	38	39	40	41	42	43	44
J	J	K	K	K	K	K	K	K
400 kw	1,700 kw	.....	675 kw	2,000 kva	450 kva	1,500 kva	2,000 kva	4,500 kva
340 kw	1,080 kw	342 kw	550 kw	1,500 kva	.....	1,200 kva	.....	4,000 kva
116 hp	548 hp	Yes	Yes	Yes	Yes	Yes	Yes	Yes
13.2	13.8	4.16	4.16	4.16	4.16	13.2	4.16	13.2
Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	.....	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	Yes	No	No
No	Yes	No	No	No	No	No	No	Yes
No	No	Yes	Yes	Yes	Yes	Yes	Yes	No
No	Yes	No	No	No	No	.....	No	Yes
.....	No	.....	.....	.....	.....	.....	.....	.....
.....	Yes	.....	.....	.....	.....	.....	.....	.....
Yes	No	No	No	No	No	No	No	No
120/208	120/208	120/240; 240	120/240; 240	120/208; 240	120/208; 240	120/240; 240	120/208; 240	120/208; 480
Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	No
Yes	.....	Yes	Yes	Yes	Yes	Yes	Yes	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
No	Yes	No	.....	Yes	No	No	No	Yes
Yes	No	No	No	No	No	Yes	No	Yes
No	No	No	Yes	Yes	Yes	Yes	Yes	No
No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	.....	No	Yes	No	No
.....	No	No	No	Yes	No	No	No	Yes
.....	No	.....	.....	No	.....	.....	.....	No
.....	Yes	.....	.....	Yes	.....	.....	.....	Yes
25; 37½	750	75; 100; 150	75; 100	225 max	150	167; 333; 300	225 max	100 to 1,000
3	3	Both	Both	3	3	Both	3	Both
No	Yes	Yes	No	No	No	No	No	Yes
Yes	No	No	Yes	Yes	Yes	Yes	Yes	No
.....	Yes	.....	Yes	Yes	Yes	Yes	Yes	Yes
.....	120	.....	240	240	240	240	240	.....
.....	No	.....	No	No	No	No	No	.....
.....	Yes	.....	.....	Yes	Yes	Yes	Yes	Yes

52	53	54	55	56	57	58	59	60
M	M	M	M	N	O	O	O	P
.....	1,200 kva	1,477 kva	12,750 kva	500 kw	475 kva	1,000 kva	1,104 kva	1,000 kw
2,500 kw	900 kva	800 kw	6,000 kva	422 kw	350 kva	500 kva	525 kva	750 kw
Yes	Yes	Yes	Yes	188 kw	120 kva	479 kva	350 kva	175 kw
12.5	4.16	4.16	12.5	13.8	4	12	12	12.5
Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	No
Yes	No	No	Yes	Yes	Yes	No	No	Yes
No	No	No	No	.....	Yes	Yes	Yes	.....
No	No	No	No	.....	No	No	No	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
Yes	Yes	Yes	No	.....	No	No	No	.....
120/208	120/208	120/208	120/208; 277/480	120/208	120/208	120/208	120/208	120/208
Yes	Yes	No	No	No	No	Yes	Yes	.....
Yes	Yes	No	No	.....	No	Yes	Yes	.....
No	No	.....	No	.....	.....	No	No	.....
No	No	Yes	Yes	Yes	Yes	No	No	.....
No	Yes	Yes	No	No	No	Yes	Yes	Yes
Yes	Yes	Yes	No	No	No	No	Yes	No
Yes	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No
Yes	No	No	Yes	Yes	Yes	No	No	Yes
No	.....	.....	No	No	No	.....	.....	No
Yes	.....	.....	Yes	Yes	Yes	.....	.....	Yes
167; 500	37½; 50; 100	15; 75; 100	500; 750; 1,000	200	167	25; 37½; 50	50; 100	50; 100; 500
Both	Single	Single	3	Single	Single	Single	Single	Both
No	No	No	No	No	No	No	No	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
120/208	120/208	240	277/480	120/208	120	120	120	120
No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes

SHOPPING CENTER DISTRIBUTION continued

SHOPPING CENTER No.	61	62	63	64	65	66	67
UTILITY SERVING	Q	R	S	S	T	U	U
Connected load	.....	900–1,100 kva	2,660 kva	3,000 kva	350 kva	730 kw	5,000 kw
Demand	4,000 kw	500 kva	1,740 kva	2,400 kva	340 kva	530 kw	3,000 kw
Air conditioning	Yes	.....	Yes	Yes	150 hp	Yes	Yes
PRIMARIES							
Voltage, kv	4.16	4.16	4.16	4.16	12	.....	12; 4.16
Overhead	No	Yes	Yes	Yes	Yes	.....	Yes
Open wire	No	Yes	Yes	Yes	Yes	.....	No
Aerial cable	No	No	No	No	No	.....	Yes
Underground	Yes	No	No	No	No	.....	Yes
TYPE PRIMARY FEED							
Radial	Yes	Yes	Yes	Yes	Yes	.....	.....
Duplicate	No	No	No	No	.....	.....	Yes
Automatic throwover	.....	.....	.....	.....	.....	.....	Yes
Manual throwover	.....	.....	.....	.....	.....	.....	No
Loop	No	No	No	Yes	.....	.....	Yes
SECONDARIES							
Voltage	120/208; 480	120/208	120/208; 230	120/208	120/208	120/208	120/208
Overhead	No	Yes	Yes	Yes	Yes	Yes	Yes
Open wire	.....	Yes	Yes	No	Yes	Yes	Yes
Aerial cable	.....	.....	No	Yes	No	No	.....
Underground	Yes	.....	No	.....	No	No	No
TRANSFORMERS							
Type installation							
Pole	No	Yes	No	No	No	Yes	Yes
Platform on poles	No	Yes	No	Yes	Yes	Yes	Yes
Ground level	No	No	Yes	Yes	No	.....	No
Platform on roof	No	No	No	No	No	.....	No
Vault	Yes	No	No	No	No	.....	Yes
Furnished by utility	No	.....	.....	.....	.....	No	No
Furnished by customer	Yes	.....	.....	.....	.....	.....	Yes
Sizes, kva	167 to 833	25; 37½; 50	150; 300; 500	75; 300; 500	100	.....	.....
Single or 3 phase	Single	Single	3	Both	Single	Single	Single
METERING							
Master	No	No	No	No	Yes	No	No
Individual customer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PARKING AREA LIGHTING							
Multiple	Yes	.....	Yes	Yes	Yes	Yes	Yes
Voltage	120/240	.....	120	120	120	120	120
Series	No	.....	No	No	No	No	No
Underground	Yes	.....	Yes	Yes	Yes	Yes	Yes

SHOPPING CENTER No.	77	78	79	80	81	82	83
UTILITY SERVING	Z	Z	AA	AB	AB	AC	AC
Connected load	350 kva	5,300 kva	4,000 kva	660 kw	1,600 kw	850 kw	1,000 kw
Demand	275 kva	4,300 kva	3,500 kva	400 kva	1,000 kw	700 kw	500 kw
Air conditioning	100 hp	550 hp	1,540 hp	300 kw	480 kw	425 kw	Yes
PRIMARIES							
Voltage, kv	12	12	13.2	12	12	12.5	12.5
Overhead	Yes	No	Yes	Yes	Yes	No	Yes
Open wire	Yes	.....	Yes	Yes	Yes	No	Yes
Aerial cable	No	.....	No	No	.....	.....	No
Underground	No	Yes	Yes	Yes	No	Yes	Yes
TYPE PRIMARY FEED							
Radial	No	No	Yes	Yes	Yes	Yes	Yes
Duplicate	No	No	Yes	No	No	No	No
Automatic throwover	.....	.....	No	.....	.....	.....	.....
Manual throwover	.....	.....	Yes	.....	.....	.....	.....
Loop	Yes	Yes	No	No	No	No	No
SECONDARIES							
Voltage	120/208	120/208; 480	120/208; 265/460	120/208	120/208	120/208	120/208
Overhead	No	No	No	No	Yes	No	Yes
Open wire	.....	.....	.....	.....	Yes	.....	No
Aerial cable	.....	.....	.....	.....	.....	.....	Yes
Underground	Yes	Yes	Yes	Yes	No	Yes	No
TRANSFORMERS							
Type installation							
Pole	No	No	No	No	Yes	No	No
Platform on poles	No	No	No	No	No	No	Yes
Ground level	Yes	No	No	No	No	No	Yes
Platform on roof	No	No	No	No	No	No	No
Vault	No	Yes	Yes	Yes	No	Yes	No
Furnished by utility	.....	.....	Yes	No	.....	No	.....
Furnished by customer	.....	.....	No	Yes	.....	Yes	.....
Sizes, kva	100	167	750	100	5 to 100	100; 167	50 to 300
Single or 3 phase	Single	Single	3	Single	Single	Single	Single
METERING							
Master	No	Yes	No	No	No	No	No
Individual customer	Yes	No	Yes	Yes	Yes	Yes	Yes
PARKING AREA LIGHTING							
Multiple	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voltage	120	480	120/208	120	120	120	240
Series	No	No	No	No	No	No	No
Underground	Yes	Yes	Yes	Yes	Yes	Yes	Yes

68	69	70	71	72	73	74	75	76
V	W	W	W	X	X	X	Y	Z
3,500 kw	1,250 kw	4,800 kw	6,200 kw	2,500 kva	1,900 kva	1,200 kva	3,000 kva	500 kva
3,000 kw	820 kw	3,700 kw	5,000 kw	1,500 kva	950 kva	520 kva	2,260 kva	.....
Yes	320 kw	Yes	Yes	600 kva	500 kva	200 kva	None	10 hp
4.8	13.2	13.2	13.2	12.5	12.5	12.5	4.16	12
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	.....	Yes
Yes	No	No	No	No	No	No	.....	No
Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Yes	Yes	Yes	Yes	No	No	No	No	No
No	No	No	No	.....	.....	.....	.....	.....
Yes	Yes	Yes	Yes	.....	.....	.....	.....	.....
Yes	Yes	No	.....	No	No	No	No	Yes
120/208	120/240	120/208	120/208	120/208; 120/240	120/208	120/240; 240	125/216	120/240
No	Yes	Yes	No	Yes	.....	Yes	No	Yes
.....	Yes	Yes	.....	Yes	.....	Yes	.....	Yes
.....	No	No	.....	No	.....	No	.....	No
Yes	No	.....	Yes	Yes	Yes	No	Yes	Yes
No	Yes	No	No	Yes	No	Yes	No	Yes
No	Yes	No	No	Yes	No	Yes	No	No
Yes	No	No	No	.....	No	No	Yes	No
No	No	No	No	.....	No	No	No	No
Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
No	.....	No	No	No	No	.....	No	.....
Yes	.....	Yes	Yes	Yes	Yes	.....	Yes	.....
300; 500	15 to 167	500; 1,000	167; 750; 1,000	.....	333	.....	500	5 to 50
3	Single	3	Both	Single	Single	.....	3	Single
No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	None
120/208	120	120	120	120	120	120	120	.....
No	No	No	No	No	No	No	No	None
Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	.....

84	85	86	87	88	89	90	91	92
AC	AC	AC	AD	AD	AE	AF	AG	AH
840 kw	550 kw	350 kw	.....	.....	600 kw	3,300 kw	1,200 kw	300 kva
600 kw	425 kw	225 kw	2,565 kva	4,300 kva	183 kw	2,000 kw	973 kw	150 kva
325 kw	225 kw	Yes	Yes	1,100 kva	Yes	Yes	345 tons	110 hp
12.5	12.5	12.5	4.16; 13.2	4.16	12.5	4.16	4.15	4.8
No	Yes	Yes	No	No	Yes	No	Yes	Yes
.....	Yes	Yes	.....	.....	Yes	.....	Yes	Yes
.....	No	No	.....	.....	No	.....	No	No
Yes	No	No	Yes	Yes	No	Yes	No	No
Yes	Yes	Yes	No	No	Yes	No	No	No
No	No	No	No	Yes	No	Yes	No	No
.....	.....	.....	.....	No	.....	No	.....	.....
.....	.....	.....	.....	Yes	.....	Yes	.....	.....
No	No	Yes	Yes	Yes	Yes	No	Yes	Yes
120/208	120/208	120/208	120/208	120/208	120/240	120/208	120/208	120/208
No	Yes	No	No	No	Yes	No	Yes	No
.....	No	.....	.....	.....	Yes	.....	Yes	.....
.....	.....	Yes	.....	.....	No	.....	.....	.....
Yes	.....	No	Yes	Yes	No	Yes	No	Yes
No	No	No	No	No	Yes	No	Yes	No
No	No	Yes	No	No	Yes	No	No	Yes
Yes	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No
No	No	No	Yes	Yes	No	Yes	No	No
No	.....	.....	No	No	.....	No	.....	.....
Yes	.....	.....	Yes	Yes	.....	Yes	.....	.....
167	75; 100	300	37½ to 250	50 to 333	.....	225 to 300	25 to 100	150
Single	Single	3	Single	Single	Single	3	Single	Single
No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
120	120	240	120	120	120	.....	120/208	120
No	No	No	No	No	No	Yes	.....	No
Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes

SHOPPING CENTER DISTRIBUTION continued

SHOPPING CENTER No.	93	94	95	96	97	98	99
UTILITY SERVING	AI	AI	AI	AJ	AK	AK	AL
Connected load	500 kw	425 kw	250 kw	600 kw	608 kva	2,300 kva	.....
Demand	450 kw	390 kw	225 kw	450 kw	419 kva	1,800 kw	1,500 kw
Air conditioning	170 tons	150 tons	77 tons	Yes	Yes	900 hp	750 hp
PRIMARIES							
Voltage, kv	13.8	13.8	13.8	13.8	12.5	12.5	13.2, 2.4
Overhead	Yes	Yes	No	Yes	Yes	Yes	No
Open wire	Yes	Yes	.....	Yes	Yes	Yes	.....
Aerial cable	No	No	.....	No	No	.....	.....
Underground	No	No	Yes	No	No	Yes	Yes
TYPE PRIMARY FEED							
Radial	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Duplicate	No	Yes	No	No	.....	No	No
Automatic throwover	.....	No	.....	.....	.....	.....	.....
Manual throwover	.....	Yes	.....	.....	.....	.....	.....
Loop	No	No	Yes	Yes	No	No	No
SECONDARIES							
Voltage	120/208	120/208	120/208	125/216	120/208	120/208	120/208, 480
Overhead	Yes	Yes	Yes	Yes	Yes	No	No
Open wire	Yes	Yes	Yes	Yes	No	.....	.....
Aerial cable	No	No	No	No	Yes	.....	.....
Underground	No	No	No	No	No	Yes	Yes
TRANSFORMERS							
Type installation							
Pole	No	No	No	No	Yes	No	No
Platform on poles	Yes	Yes	No	No	Yes	No	No
Ground level	No	No	Yes	Yes	No	No	No
Platform on roof	No	No	No	No	No	No	No
Vault	No	No	No	No	No	Yes	Yes
Furnished by utility	.....	.....	.....	.....	.....	No	No
Furnished by customer	.....	.....	.....	.....	.....	Yes	Yes
Sizes, kva	100	25, 75, 112½	300	500	112½, 150	500	.....
Single or 3 phase	Single	Both	3	3	3	3	3
METERING							
Master	No	No	No	No	No	No	No
Individual customer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PARKING AREA LIGHTING							
Multiple	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Voltage	120	120	120	120	120	120	120
Series	No	No	No	No	No	No	No
Underground	Yes	Yes	Yes	No	Yes	Yes	Yes

SHOPPING CENTER No.	109	110	111	112	113	114	115
UTILITY SERVING	AQ	AR	AR	AR	AR	AR	AS
Connected load	.....	.....	.....	.....	.....	.....	5,700 kw
Demand	10,000 kva	1,750 kva	1,500 kva	815 kva	960 kva	1,130 kva	3,010 kva
Air conditioning	Yes	200 kva	.....	.....	.....	.....	None
PRIMARIES							
Voltage, kv	13.2	4.16	4.16	4.16	4.16	4.16	4.16
Overhead	Yes	Yes	Yes	Yes	Yes	Yes	No
Open wire	Yes	Yes	Yes	Yes	Yes	Yes	.....
Aerial cable	No	.....	.....	No	No	No	.....
Underground	Yes	Yes	Yes	No	Yes	No	Yes
TYPE PRIMARY FEED							
Radial	No	Yes	Yes	Yes	Yes	Yes	Yes
Duplicate	Yes	No	No	No	No	No	No
Automatic throwover	Yes	.....	.....	.....	.....	.....	.....
Manual throwover	.....	.....	.....	.....	.....	.....	.....
Loop	Yes	No	No	No	No	No	Yes
SECONDARIES							
Voltage	120/208	120/208	120/208	120/208	120/208, 120/240, 240	120/208, 240	120/208, 480
Overhead	No	.....	.....	Yes	Yes	Yes	No
Open wire	.....	.....	.....	Yes	.....	Yes	.....
Aerial cable	.....	.....	.....	.....	.....	No	.....
Underground	Yes	.....	.....	No	.....	No	Yes
TRANSFORMERS							
Type installation							
Pole	No	No	No	No	No	Yes	No
Platform on poles	No	No	No	Yes	Yes	Yes	No
Ground level	No	No	No	No	No	No	No
Platform on roof	No	No	No	No	No	No	No
Vault	Yes	Yes	Yes	No	Yes	No	Yes
Furnished by utility	Yes	No	No	.....	No	.....	No
Furnished by customer	No	Yes	Yes	.....	Yes	.....	Yes
Sizes, kva	1,000	167, 250	167	37½, 50, 75	37½ to 100	37½ to 100	100 to 250
Single or 3 phase	3	Single	Single	Single	Single	Single	Single
METERING							
Master	No	No	No	No	No	No	No
Individual customer	Yes	Yes	Yes	Yes	Yes	Yes	Yes
PARKING AREA LIGHTING							
Multiple	Yes	Yes	No	Yes	.....	.....	Yes
Voltage	120/240	120	.....	.....	.....	.....	120/208
Series	No	No	Yes	.....	.....	.....	No
Underground	Yes	Yes	Yes	Yes	Yes	Yes	Yes

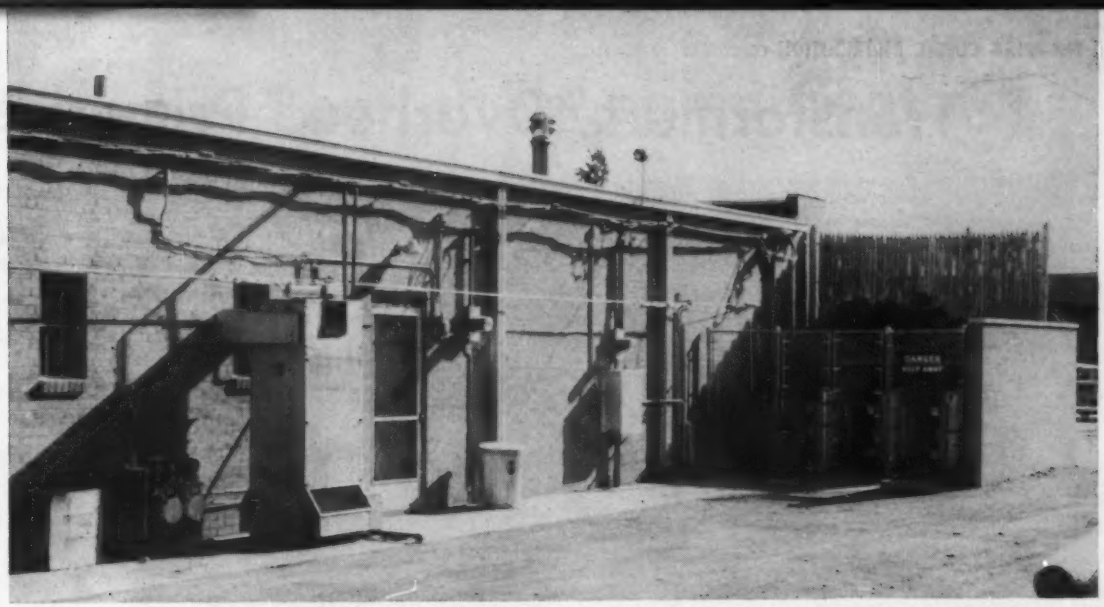
100	101	102	103	104	105	106	107	108
AM	AM	AM	AN	AO	AP	AP	AQ	AQ
4,270 kw	1,250 kw	1,800 kw	500 kw	350 kw	1,500 kw	1,100 kw	.....	.....
2,958 kw	848 kw	1,248 kw	300 kva	200 kw	420 kw	600 kw	2,700 kva	13,000 kva initial; 20,000 kva future
Yes	300 kw	500 kw	170 kva	120 hp	250 hp	50 hp	Yes	Yes
4.34	34.5; 4.8	34.5; 4.8	4.16	4.16	4.16; 12	4.16	13.2	13.2
Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No
Yes	Yes	Yes	Yes	Yes	Yes	.....	Yes	.....
No	.....	.....	.....	.....	.....	.....	No	.....
Yes	Yes	No	.....	No	Yes	Yes	Yes	Yes
.....	.....	Yes	Yes	Yes	Yes	Yes	No	No
.....	Yes	Yes	No	No	No	No	No	No
.....	.....	.....	.....	.....	.....	.....	.....	.....
.....	Yes	.....	No	No	No	No	.....	.....
.....	.....	.....	.....	.....	.....	.....	Yes	Network
480	120/208	120/208	120/208	120/208	120/240	120/240	120/208	120/208
No	No	Yes	No	Yes	No	No	No	No
.....	.....	.....	.....	No	.....	.....	.....	.....
.....	.....	.....	.....	Yes	.....	.....	.....	.....
Yes	Yes	No	Yes	No	Yes	Yes	Yes	Yes
No	No	Yes	No	No	No	No	No	No
No	No	No	No	Yes	No	No	No	No
No	Yes	Yes	Yes	No	Yes	Yes	No	No
No	No	No	No	No	No	No	No	No
Yes	Yes	No	No	No	Yes	Yes	Yes	Yes
No	No	.....	No	.....	No	No	Yes	Yes
Yes	Yes	.....	.....	.....	Yes	Yes	No	No
500	667	833	100	100	25 to 100	10 to 100	300; 500; 1,000	500; 1,000
3	Single	Single	Single	Single	Single	Single	3	3
Yes	Yes	Yes	No	No	No	No	No	No
.....	No	.....	Yes	Yes	Yes	Yes	Yes	Yes
No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
.....	.....	.....	120	120/208	120/240	120/240	120/240	.....
Yes	.....	.....	.....	No	No	No	No	No
Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes

116	117	118	119	120	121	122	123	124
AT	AT	AT	AT	AU	AU	AU	AV	AW
11,000 kva	6,500 kva	9,000 kva	1,250 kva	3,000 kva	15,000 kva	4,500 kva	1,400 kw exist; 1,190 kw prop add	1,300 kw
6,000 kva	3,700 kva	5,000 kva	700 kva	2,000 kva	10,000 kva	4,000 kva	1,200 kw exist; 1,000 kw prop add	900 kw
1,000 hp	1,500 hp	2,400 hp	500 kva	800 kva	4,000 kva	.....	759 kw	320 tons
4.8	34.5; 4.8	34.5; 4.8	4.8	12	12	12	4.8	12.5
No	No	Yes	Yes	Yes	No	No	Yes	Yes
.....	.....	Yes	Yes	Yes	.....	.....	Yes	Yes
.....	.....	.....	.....	.....	.....	.....	.....	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	No	Yes	Yes	No	No	No	No	Yes
Yes	Yes	Yes	No	Yes	Yes	Yes	No	No
Yes	Yes	Yes	.....	No	Yes	Yes	.....	.....
Yes	Yes	Yes	.....	Yes	No	No	.....	.....
Yes	Yes	Yes	No	No	No	No	Yes	No
120/240; 240; 480	120/240; 240; 480	120/240; 240; 480; 4,160	120/240; 240	120/240; 240	120/240; 480	120/208; 4,160	120/208	120/208
No	No	No	No	No	No	No	Yes	Yes
.....	.....	.....	.....	.....	.....	.....	Yes	.....
.....	.....	.....	.....	.....	.....	.....	.....	.....
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No	No	No	No	No	No	No	No	Yes
No	No	No	No	No	No	No	Yes	Yes
No	No	No	No	No	No	No	No	No
No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
In streets	In streets	In streets	No	No	No	No	No	No
On priv prop	On priv prop	On priv prop	Yes	Yes	Yes	Yes	Yes	Yes
100 to 333	100 to 833	100 to 1,000	150; 250	167 max	250; 1,000	250; 833	75 to 250	37½ to 167
Single	Single	Single	Single	Both	Single	Single	Single	Single
No	No	No	No	No	No	No	No	No
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yes	Yes	Yes	Yes	.....	Yes	No	Yes	Yes
240; 480	240; 480	120/240	240	.....	480	.....	120/208	120/208
No	No	Yes	No	.....	No	Yes	No	No
Yes	Yes	Yes	Yes	.....	Yes	Yes	Yes	Yes

Table II – Emergency Service Provisions

No special provisions were made to assure service continuity for 75 of the 124 shopping centers covered in the survey. Here are the steps taken to guard against blackout in the remaining 49 centers

Company	Shopping Center No.	Blackout Prevention Measures
A	1 & 2	Looped primary 2nd circuit available
A	3	Automatic throwover at substation
A	4	All escalators have duplicate primary feed with secondary selective throwover
B	5	Primary and secondary networks
B	6	Duplicate primary feed
B	7	Open loop primary with sectionalizing between transformers
B	8	Looped primary. Automatic throwover. Spot secondary net
B	9	Duplicate primary from substation, looped through secondaries of one large customer
B	10	Primaries connected like station ring bus with sectionalizing between transformers
D	18	Two 34.5-kv circuits with primary selective switching and emergency lighting supplied by batteries with automatic throwover
D	19	Duplicate primary feed with emergency battery lighting
I	34	Duplicate primary supply with automatic throwover and spot secondary network
J	37	Duplicate primary feed
K	40 & 41	Parking area lighting separate
L	45, 46 & 47	Area served by overhead primary network. Switches on each side of tap to shopping center
L	48	Area served by primary network
M	50, 51, 52, 53 & 54	Looped primary feed
M	55	Three primary network feeders. Secondary bussed through network protector on each transformer in each vault
S	63 & 64	Large stores provide own emergency lighting
T	65	Some emergency lighting from automatic batteries with trickle chargers
U	67	Some stores have battery-operated emergency lights
W	70	Duplicate underground connection to overhead lines
W	71	Underground loop from overhead with connections at two points and sectionalizing between these
Y	75	Fed from primary network
Z	78	Looped primary supply plus two 25-kw motor-generator sets for emergency lights and storm pumps
AC	83	Several transformer banks each fed from two primary sources. Each source has alternate substation supply available
AC	86	Two primary sources available. Each has alternate substation source
AD	87 & 88	Large stores provide own emergency lighting
AF	90	Duplicate primary feed
AJ	96	Emergency supply from separate source
AK	97	Customer furnishes emergency lighting
AQ	108	Second contingency network
AQ	109	Duplicate and looped primaries and secondary network
AS	115	Served by four primary feeders from two substations. Secondaries tied together and sectionalized
AT	116	Two stores have e-g sets
AT	117 & 118	Large stores have e-g sets
AU	121 & 122	Large store has engine-generator



MULTIPLEX CABLES OFTEN RUN FROM GROUND-TYPE TRANSFORMER TO BUILDING AND ALONG WALL (CENTER NO. 82)

Few Secondaries Are Required

Secondaries are, in general, conspicuous by their absence. More often than not, services are taken directly from transformers to customers' wiring. When secondaries are required, there is the problem of how to provide the many and the heavy conductors required to do the job. Solutions, for overhead construction include:

1. Conventional, open-wire construction, either on cross-arms, brackets or with vertical construction on strain insulators.

2. Multiplex conductors bracketed along building walls with taps for individual customers as required.

3. Open wire secondaries run on brackets along building.

CONVENTIONAL OVERHEAD construction presents problem of many heavy secondary conductors and clutter of poles

SECONDARIES ARE INSTALLED ON BRACKETS ON BUILDING WALLS IN SOME INSTANCES AS SHOWN IN CENTER NO. 15

Transformers, Overhead Primaries

Overhead 12.5-kv primaries (No. 1/0 ACSR) supply a ground-level transformer bank for Center No. 23 whose demand is 600 kva. Transformer bank consists of three 250-kva units and is surrounded by a cyclone fence. Lines and transformers are in the rear of buildings where there is no objection to this type of construction from the public or city authorities.

Secondaries consist of two 500-MCM conductors per phase and extend directly from transformer bus through the wall to the meter room.

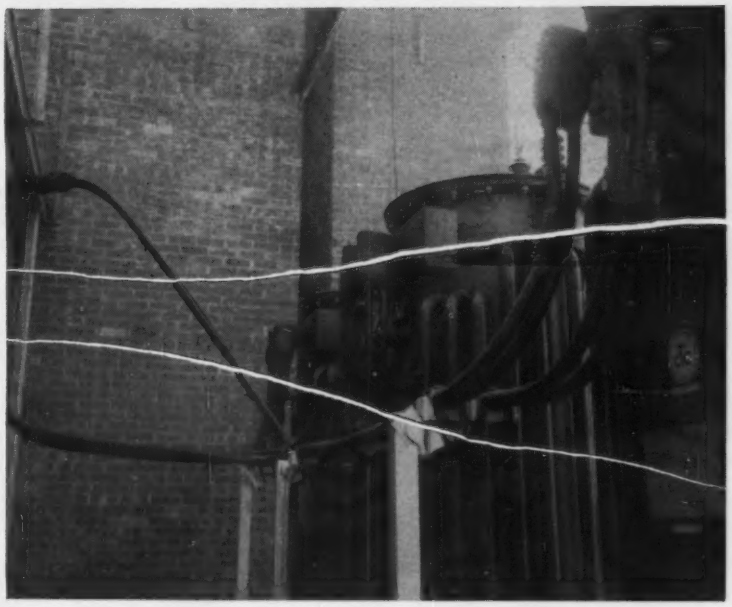
This center is served at 265/460 v which simplified the problems of carrying the heavy loads to the stores without excessive voltage drop. This also keeps losses to a minimum.

Meters are grouped in one room. Dry-type transformers supply 120-v requirements.

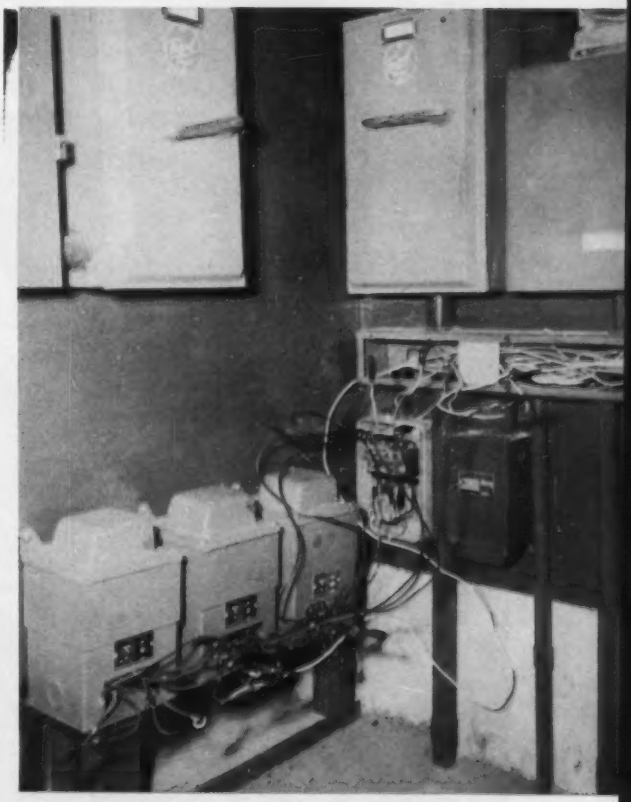
OVERHEAD 12.5-KV PRIMARIES of 1/0 ACSR conductors feed 750-kva, 12.5-kv/265-460-v transformer bank in rear of shopping center where such construction is acceptable. Transformers are switched by a gang-operated, pole-top switch

Placed in Rear of Shopping Center

SECONDARIES, two 500-MCM conductors per phase, extend through the building from transformer secondary to meter room. Voltage is 265/460



METERS ARE GROUPED in room adjacent to transformer bank. Switches on wall at right in top picture are backed up by meters and switches on opposite side of same wall shown at left in picture at bottom of the column



DRY-TYPE TRANSFORMERS are used to step down voltage of secondaries from 265/460 to 120 to serve appliances

AERIAL CABLE TO STRUCTURE ON ROOF FEEDS TRANSFORMERS IN VAULT ON MEZZANINE FLOOR BEHIND VENTILATOR

SHOPPING CENTER DISTRIBUTION continued

Vault Installed on Mezzanine Floor

Distribution engineers devised ingenous methods of solving problems on each job. For Center No. 1, No. 2 multiplex primary cable was run to a structure on the building roof. A pothead was installed on this structure and No. 2 PILC cable was installed in 3-in. metal conduit from there to a vault on the mezzanine floor. Potheads are 7,500-v outdoor/indoor type.

Three 100-kva, 4,800-v, Askarel-filled transformers were installed. The vault was designed to accommodate up to three 167-kva transformers. Secondaries are 120/208 v.

Cost was less than that of straight underground construction, and results were satisfactory. However, engineers for the utility preferred the roof-type transformer.

VAULT ON MEZZANINE floor is fed by cable from pothead on roof. Primary voltage is 4,800 and secondary is 120/208

CONSULTING ENGINEERS: SARGENT AND LUNDY

G-E progress in cross-compound design offers

MORE ECONOMY FOR TODAY'S HIGHER RATINGS

Keeping pace with today's demands for higher ratings and greater efficiencies are General Electric developments in cross-compound turbine-generator design. This design separates high- and low-pressure sections, permitting greater efficiency in each. Latest G-E cross-compound designs offer better economies than ever before obtainable.

An application of this design is Unit No. 2 (above), now in operation in the Will County Station of the Public Service Company Division, Commonwealth Edison Company. Located near Chicago, the Will County Station is an important power producer for Northern Illinois.

This installation typifies the vigorous efforts being made by progressive electric utility companies to expand and improve the efficiency of their power generation systems to provide adequate low-cost electricity for increasing loads.

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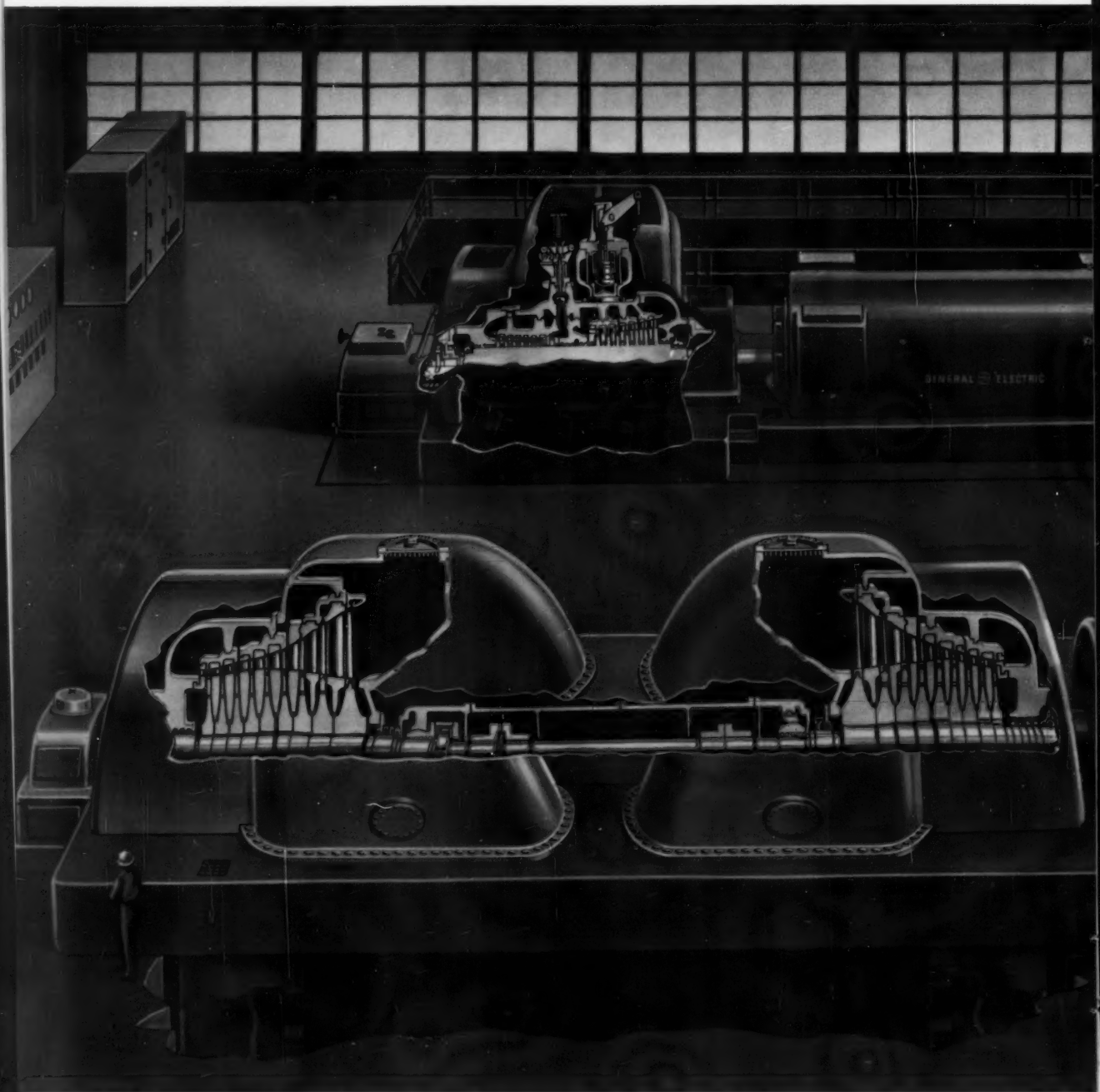
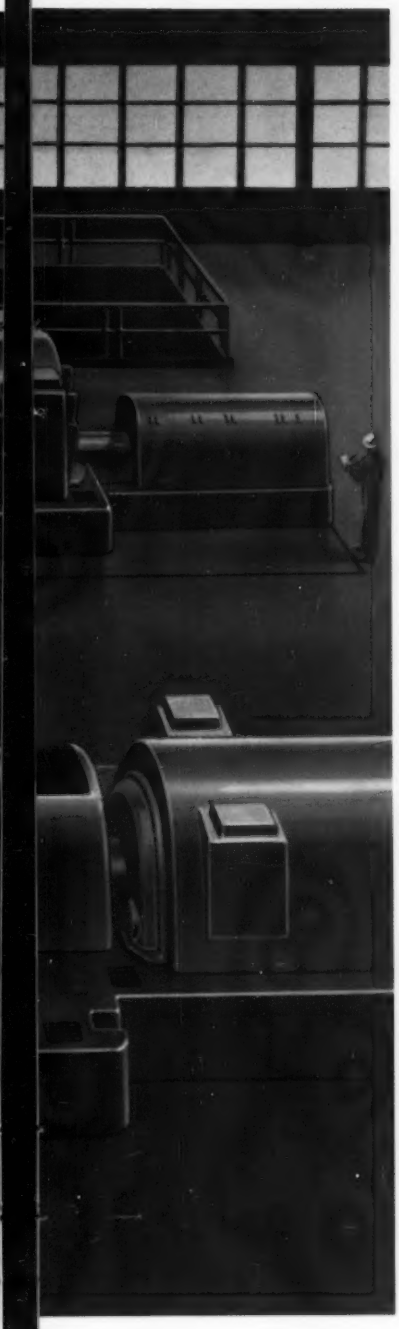
Now G-E design of cross-compound



LOW-PRESSURE SECTION (front) with 38-inch last-stage buckets carries 40% of unit's total load and operates at 1800 rpm. Low-pressure (about 80 psig) and low-temperature (560 F) steam enters opposite ends of section, flows towards center. Steam exhausts downward to condenser through a single condenser opening. Low speed allows use of large, efficient last-stage buckets and liberal exhaust hoods—two features vital to the efficient performance of higher-rated turbines operating at low-exhaust pressures.

HIGH-PRESSURE SECTION (rear) of opposed-flow design carries 60% of unit's total load and operates at 3600 rpm. Steam enters in the center, flows to the left (or front), exhausts downward. Reheated in the boiler, it re-enters turbine adjacent to initial steam entry, flows to the right, exhausts to crossover pipes leading to low-pressure turbine. This design permits admission of both initial and reheat steam near the center of the high-pressure casing, thus concentrating high temperatures in a small area.

units brings new high in efficiency



Longer last-stage buckets in low-pressure section give maximum efficiency

The 1800 rpm speed of the low-pressure section permits the use of longer last-stage buckets which provide greater efficiency at low exhaust pressures. On a 250,000 kilowatt cross compound unit, for example, this can mean a saving of as much as 50 million pounds of coal per year.

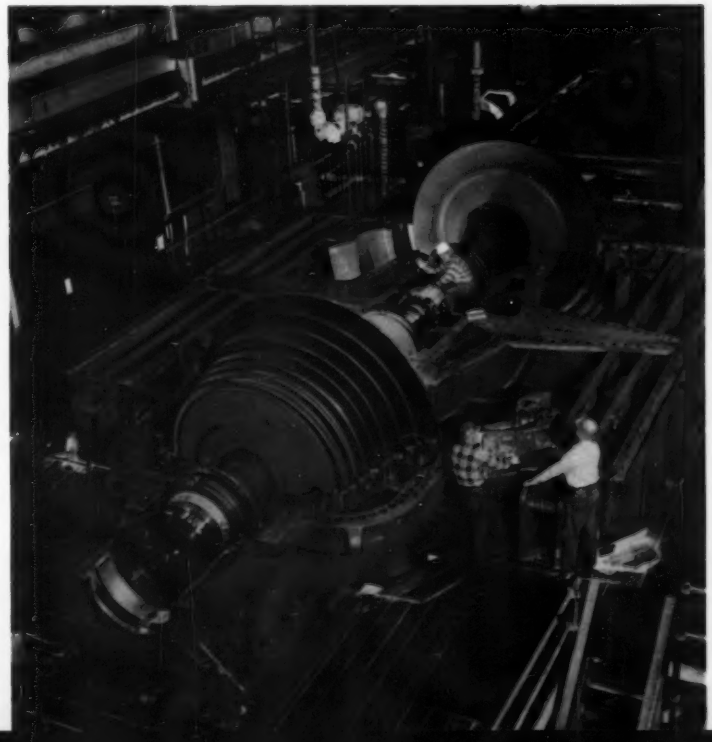
In the 3600 rpm high-pressure section, General Electric's opposed-flow design avoids severe temperature gradients with resulting thermal distortion by concentrating all high-steam temperatures in one small area of the casing. This design and the use of special high-pressure, high-temperature parts has resulted in outstanding efficiency.

Because there are two sections, each is comparatively short—a feature helpful in making more compact station arrangements. In fact, some designs of cross-compound units can easily be fitted into extensions of existing stations which cannot accommodate other designs of equal rating.

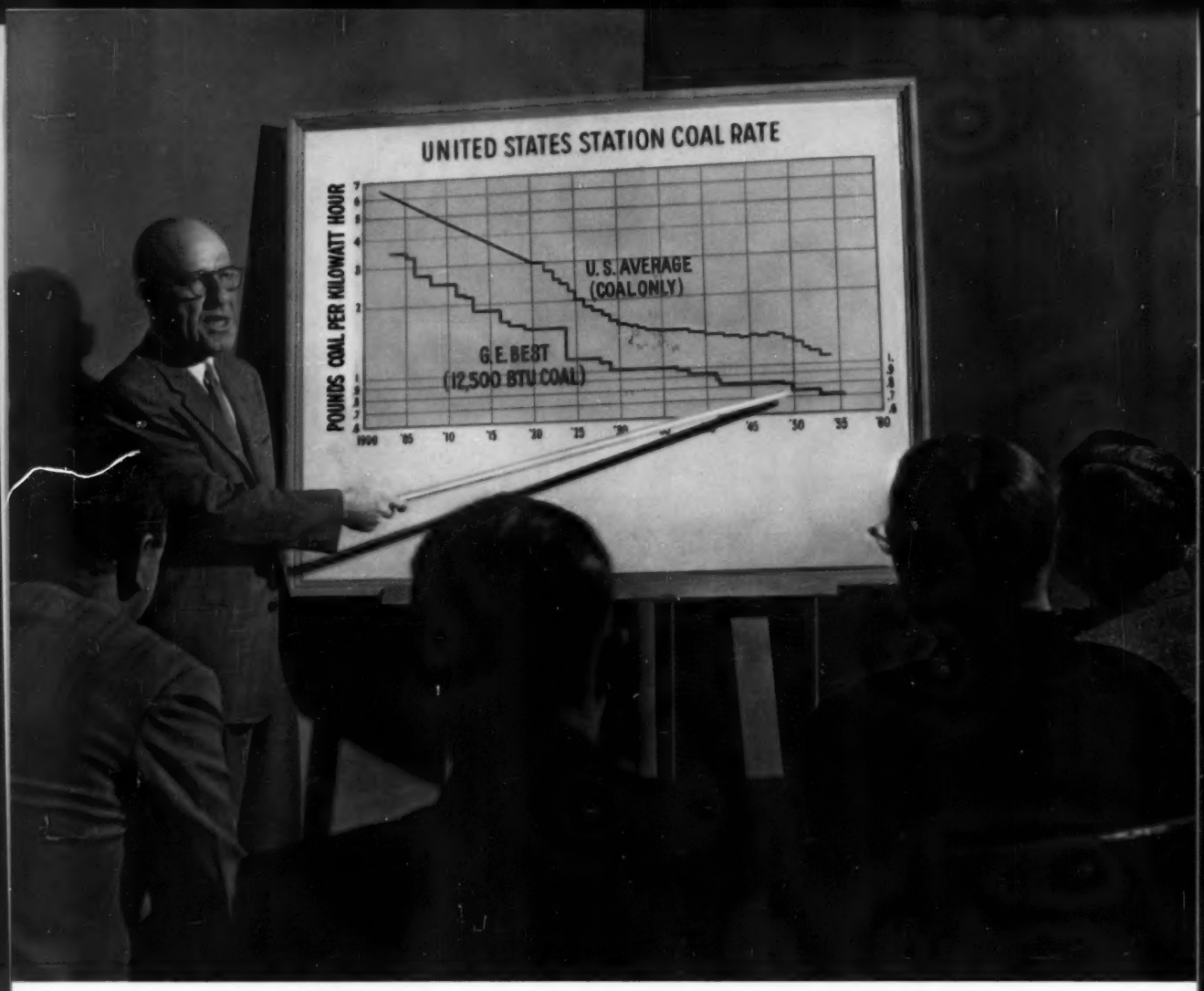
These are but a few of the ways in which General Electric's cross-compound design and arrangement have already achieved new highs in operating economy for turbine-generators. Read what C. W. Elston has to say about future turbine fuel economy on the next page.

Leader in Turbine-Generator Progress

GENERAL ELECTRIC



LOW-PRESSURE SECTION being assembled for careful factory inspection. This unit is one of the many large cross-compound turbines now being shipped to progressive electric utilities.



Can Turbine Fuel Economy Be Improved?

A statement by C. W. Elston, Manager—Turbine Engineering

The past twenty years have seen a phenomenal rise in the efficiency of steam turbine-generators. The best General Electric unit today requires 29 percent less fuel per kilowatt hour generated than the most efficient unit of twenty years ago. Can this improvement record be continued over the years to come?

It seems safe to answer that question in the affirmative. While future gains may not be quite so spectacular, there is considerable room for further improvement. The future increase in steam turbine-generator efficiency will come in part from the use of higher steam pressures and temperatures, and in part as a result of further development in the art of designing turbines.

The opportunity for continuing improvement in turbine efficiency presents a challenge that is being met by the ingenuity and creativity of many G-E people in research, engineering, and manufacturing. Large Steam Turbine-Generator Department, General Electric Company, Schenectady 5, New York.

254.21

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BEFORE lighting was improved maintaining substation was difficult in illumination afforded by older type lighting

SUBSTATION—Design

New Substation Lighting Aids Maintenance

Fluorescent luminaires installed by Louisiana P&L on substation fence expedite equipment inspection and have effect too of improving public relations

W. L. RUSH, Transmission and Distribution Engineer, Louisiana Power & Light Co, New Orleans, La.

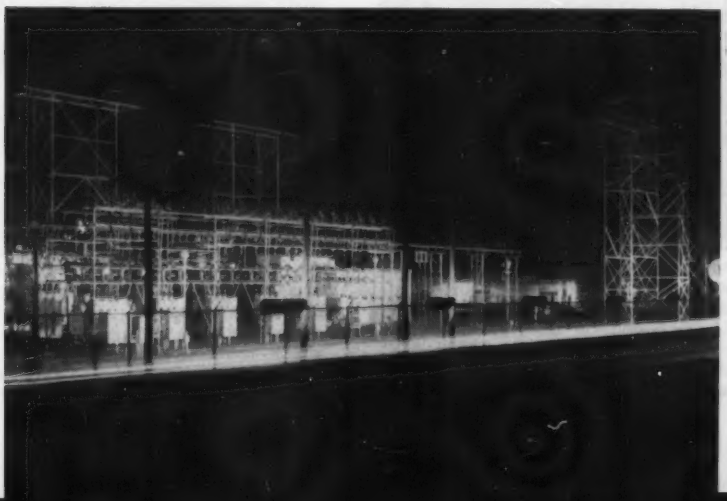
A new lighting scheme consisting of fluorescent luminaries mounted on a substation fence has been installed by Louisiana Power & Light Co. By vastly improving the substation illumination at night, the scheme expedites maintenance and inspection of equipment and improves public relations.

In the West Monroe installation, two-lamp fluorescent luminaries are mounted along the top railing of the substation fence's front side. They are spaced 30 ft apart and are 6 ft high. Because this is the trial installation, the 120-v cable was connected in a temporary manner. At future installations the cable will be pulled through the upper pipe rail of the fence, and there will be a conduit fitting at each feed point.

The results achieved are beyond expectations. Immediately in front of the 13.8-kv breakers, 30 ft from the fence, the light intensity is 5 ft-c in line with a fixture and 4 ft-c midway between fixtures. These measurements were at the elevation of the luminaries.

About 60-ft from the fence, in front of the metal-clad switch-gear, the intensity is more than 2 ft-c, with 1 ft-c reflected from the aluminum-painted enclosure. At the farthest transformer from the fixtures 1 ft-c was measured, with ½ ft-c reflected.

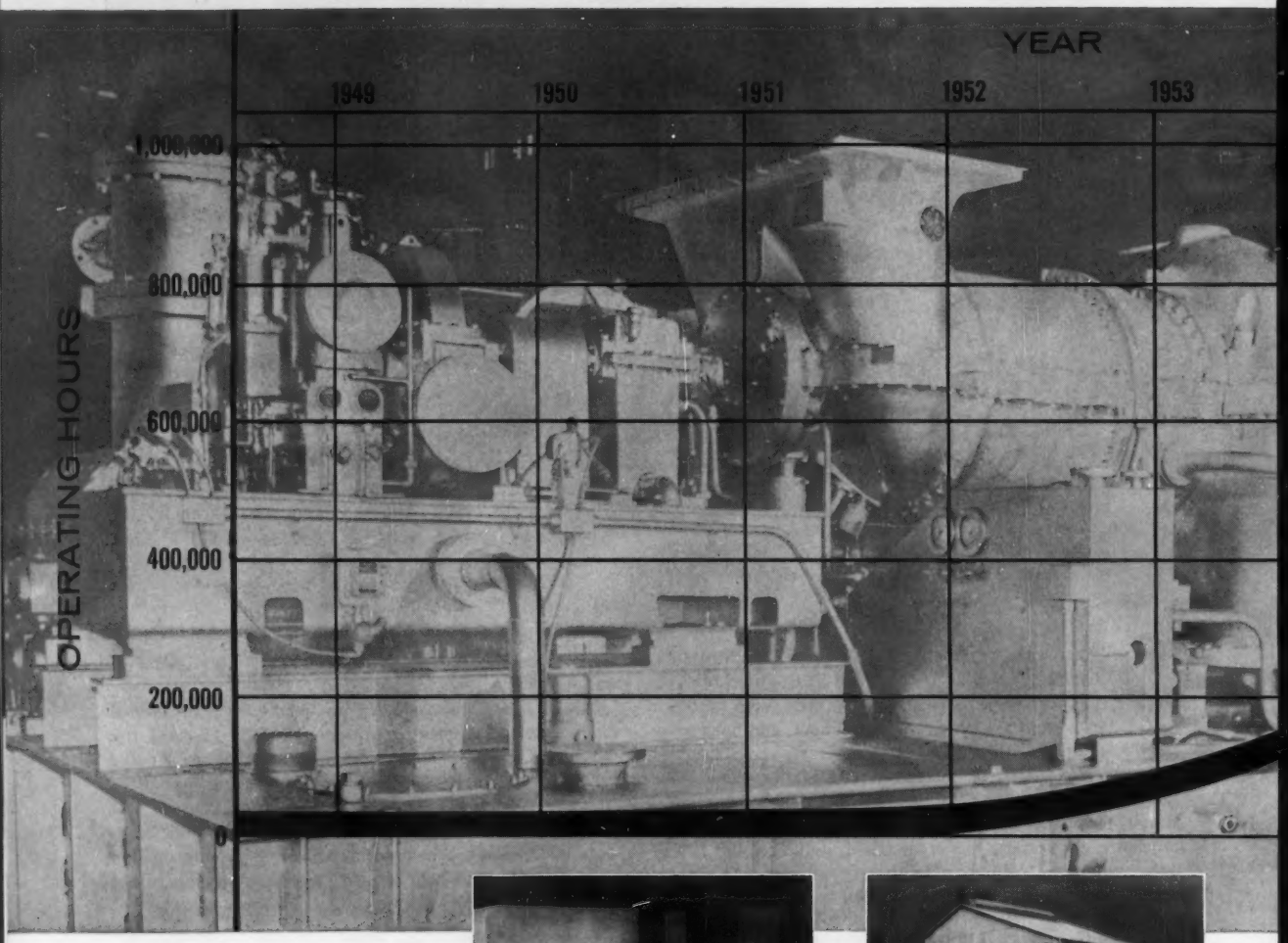
Since the installation was made, many favorable comments have been received from motorists, driving on one of the most-traveled highways in Louisiana which is about 400 ft from the substation.



AFTER fluorescent luminaires were installed inspection of equipment was easy and substation's appearance was enhanced

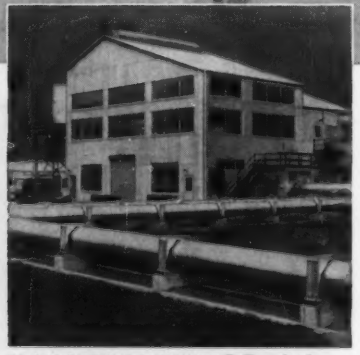
(*More How To on page* 136)

General Electric Gas top 1,000,000 hours



The Million Hours of operating time shown on the graph above have been logged in applications similar to those shown at right →

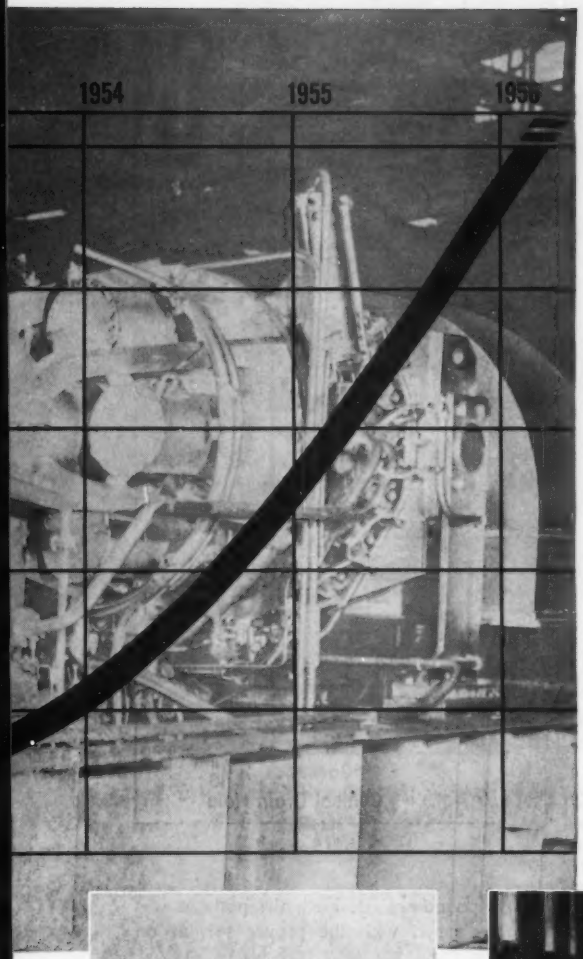
IN POWER GENERATION, G-E gas turbines are continuing to prove an economical addition to steam turbine-generator systems. In one installation, the addition of a gas turbine to the steam station cycle improved the heat rate 15%. Naturally, improvements will depend on existing station conditions.



IN GAS PIPELINE PUMPING, G-E units lower pumping costs. G-E gas turbines are ideal for these installations as they go on the line in less than 15 minutes, can operate virtually unattended, use gas from pipeline as fuel. Little or no water, only a small amount of lubricating oil are required.

Turbines of service

Now, new ratings from 4750 to 28,400 kw promise even wider use of G-E units in electric utility power generation



With an impressive 1,000,000 hours to their credit in varied applications, General Electric gas turbines are now becoming an increasingly important consideration in the selection of power plants for utility power generation. As versatile, low-cost, self-contained power makers, they offer particularly attractive opportunities for use as peak-load and standby units—as well as in small and medium base-load plants, end-of-line generating installations and combined gas turbine-steam turbine cycles.

LOW OPERATING COSTS of General Electric gas turbines have been proved through 114 machine years of service in more than 100 industrial and utility installations. Suitable for remote, unattended operation and containing few wearing parts, a G-E gas turbine power plant requires very little maintenance. According to one user, maintenance costs have amounted to only 0.2 mills per kilowatt hour. In addition, installation cost per kilowatt is less for a General Electric gas turbine-generator station than for other complete power plants of comparable size. Gas turbines up to 9200 kw are shipped and installed on an integral base requiring only a small area and a simple foundation.

NEW RATINGS FROM 4750 to 28,400 kw promise to open up a broader field of application where the unique features of the gas turbine can bring even greater economies.

Your nearest Apparatus Sales Office will be glad to consult with your engineers and show how the special advantages of a G-E gas turbine can be applied to your operation. Or write Section **261-18A,** General Electric Co., Schenectady 5, N. Y.

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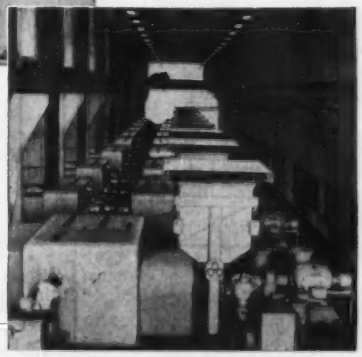
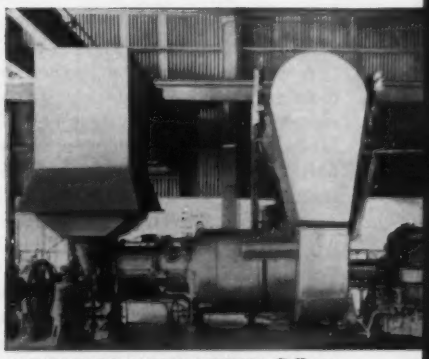
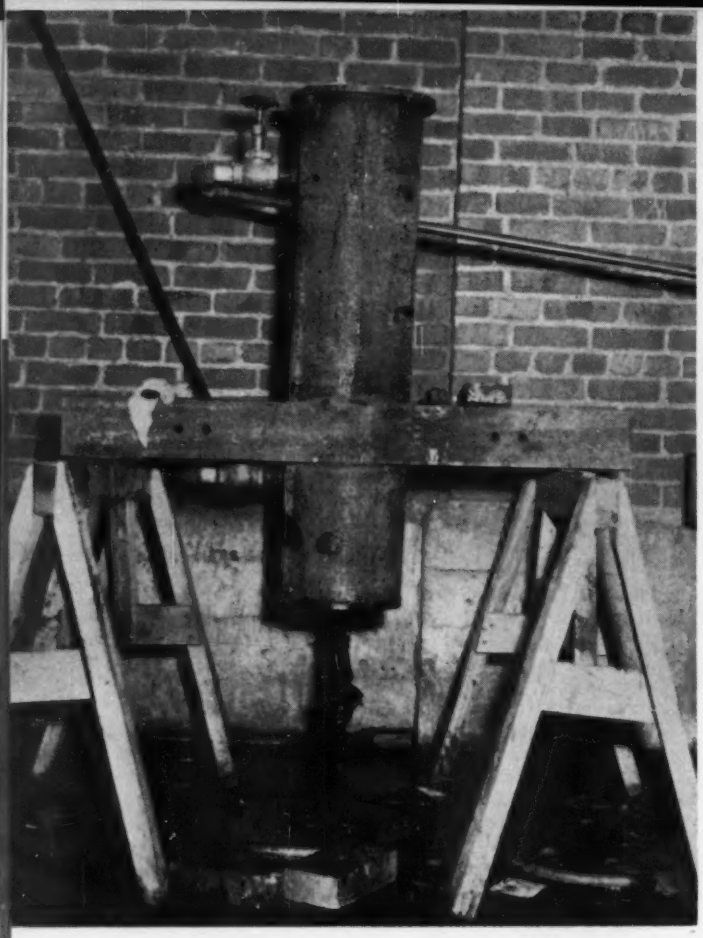
IN RAILROADING, G-E gas turbines have proved their dependability under severe operating conditions. Utilizing low-cost residual fuels, units pack tremendous power for their size and weight. A new G-E 8500 hp gas turbine-electric locomotive can do the work of 5 diesel locomotives.

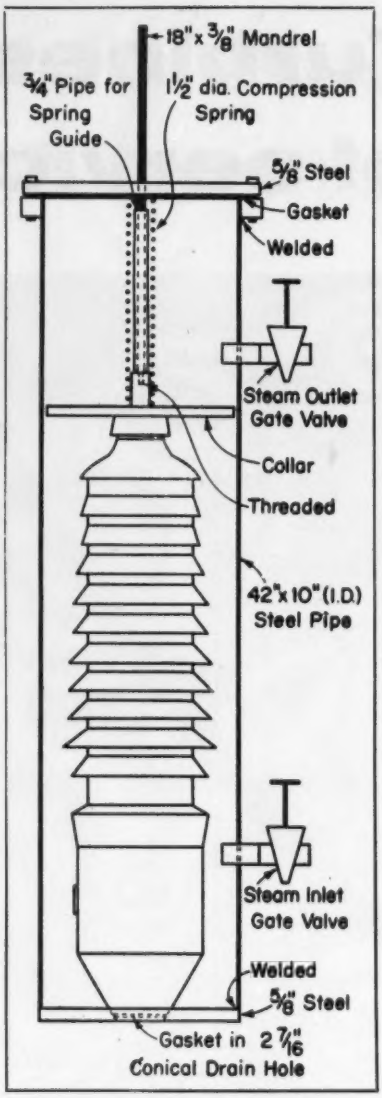


IN PETROLEUM PRODUCTION, G-E units are used in oil-field pressure maintenance. Driving centrifugal compressors, G-E gas turbines re-inject high pressure gas to oil fields . . . thus increasing petroleum yield. Simplicity of installation, ability to operate with little attention are prime advantages.



IN THE PETROCHEMICAL INDUSTRY, G-E gas turbine is relied upon for continuous 24-hour compressor service. In addition, significant savings are realized by using the hot exhaust gas in heat recovery boiler to make process steam—a good example of the versatility of gas turbine operation.





SUBSTATION—Maintenance

Steam Jacket Reclaims Potheads at $16 each

R. C. SCARLETT, Station Supervisor, Kingsport Utilities, Inc., Kingsport, Tenn.

A simple, inexpensive method of draining compound cut the cost of reclaiming terminal potheads of lead cables replaced in rebuilding a Kingsport Utilities, Inc., distribution substation.

After the cable and pothead sleeve has been cut off and the cable attachment removed, each pothead was carefully set inside a steel steam jacket. Steam at about 400F and low pressure was admitted slowly near the lower end of the jacket to raise the temperature of the porcelain and metal parts gradually without cracking them. The melting compound flowed out at the bottom of the pothead through a conical hole in the jacket and released the remaining cable.

Leakage of steam and hot water was prevented by the conical gasket and adjustment of the steam inlet and outlet valves to prevent excess pressure and discharge.

Flash Points Checked

Before application of this drainage method, the melting, pouring, and flash points of the compound were checked, and precautions taken to avoid burns from the jacket, steam, and pothead drainage. These precautions are necessary. After the compound was drained, the pothead was cleaned with the proper solvent on a rag.

The steam jacket was made by a local shop for $71, and was set on saw horses adjacent to a local manufacturing plant having process steam. Such steam is probably available in most areas.

Cost of reclaiming each pothead was estimated at $16 for labor, along with a small portion of the fixed charges on the jacket. Even with the addition, the expense permits a substantial saving over the cost of new potheads ranging up to $150 for the types reclaimed.

(*More How To on page* 140)

Instruments for Load Analysis

GENERAL ELECTRIC RECORDER HAS HOOK-ON TRANSFORMER ASA RATED TO 8700 VOLTS

Here's an Easy Way to Help Solve Coming Electrical Load Problems

G-E inkless recorder allows fast hook-on installation; can operate continuously for 30 days without attendance

FOR LOAD ANALYSIS, the General Electric CF-7 hook-on recorder provides an easy way to obtain accurate records of electrical loads. This versatile instrument can measure and record either current or voltage without interrupting service. Fast, convenient, hook-on installation and the ability to operate continuously for 30 days without attendance make the recorder ideal for checking growing commercial and industrial loads.

INSTALLATION of the lightweight, portable instrument for recording either current or voltage requires only four simple steps. (See explanation at right.) Once the recorder is installed, little servicing is necessary other than replacing record rolls. Inkless recording means that there are no messy inkwells to clean. Weatherproof for dependable outdoor use, the recorder can operate accurately in a wide range of ambient temperatures. You can use the CF-7 recorder in any one of seven ranges: 15/75/150/750 amperes, a-c; and 150/300/750 volts, a-c. The butyl-molded hook-on transformer is ASA rated up to 8700 volts and the transformer secondary is short-circuit protected for operating safety.

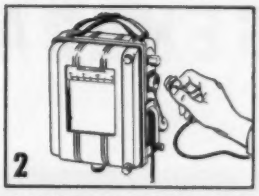
SEE FOR YOURSELF how the General Electric CF-7 hook-on recorder can help solve coming electrical load problems. Write Section 582-14, General Electric Co., Schenectady 5, New York, and ask for bulletins GEA-6104 and GEC-215, or contact your nearest G-E Apparatus Sales Office.

GENERAL ELECTRIC

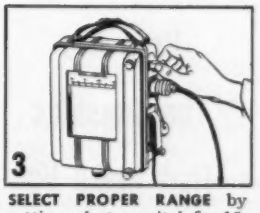
EASY TO USE

For recording current . . .

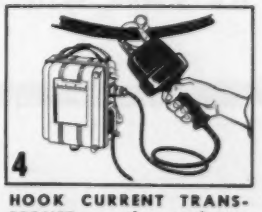
MOUNT RECORDER on pole or other convenient location. Connect recorder to either 120-volt or 240-volt power supply (50 or 60 cycles).



CONNECT TRANSFORMER LEAD to special socket on the side of the recorder.



SELECT PROPER RANGE by setting selector switch for 15, 75, 150, or 750 amperes.



HOOK CURRENT TRANSFORMER on the conductor which is to be checked.

NEW G-E AUTOMATIC

Automatically Computes and Executes

The Most Economical Loading Schedules

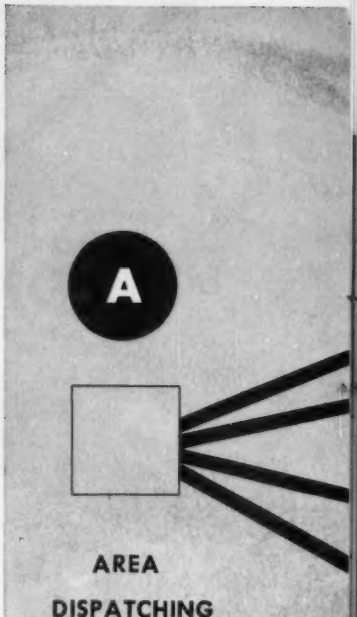
To help solve the problem of meeting power demand at the lowest possible cost, General Electric has developed a new, integrated system for automatic dispatching of generation.

A RADICALLY IMPROVED SOLUTION to the dispatch of an entire power system, the General Electric automatic dispatching system both computes and executes the most economical loading schedules. The costly, time-consuming job of detailed scheduling is completely eliminated.

MINIMUM FUEL INPUT TO BOILERS is assured because the most economical loading schedules, limited by practical conditions, are automatically computed and executed continuously.

CO-ORDINATED CONTROL is provided by the new G-E system because it automatically combines data handling, communication, computation, and routine supervision.

FURTHER INFORMATION may be obtained by contacting your nearest G-E Apparatus Sales Office, or write Section 585-13, General Electric Company, Schenectady 5, New York.



AREA DISPATCHING OFFICE

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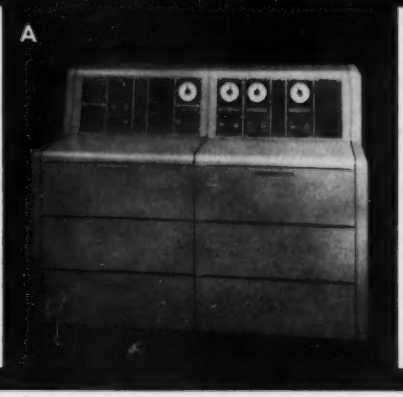
Here Are The Consoles That Make Up G.E.'s New System

MASTER AREA AND DISPATCHING CONSOLE

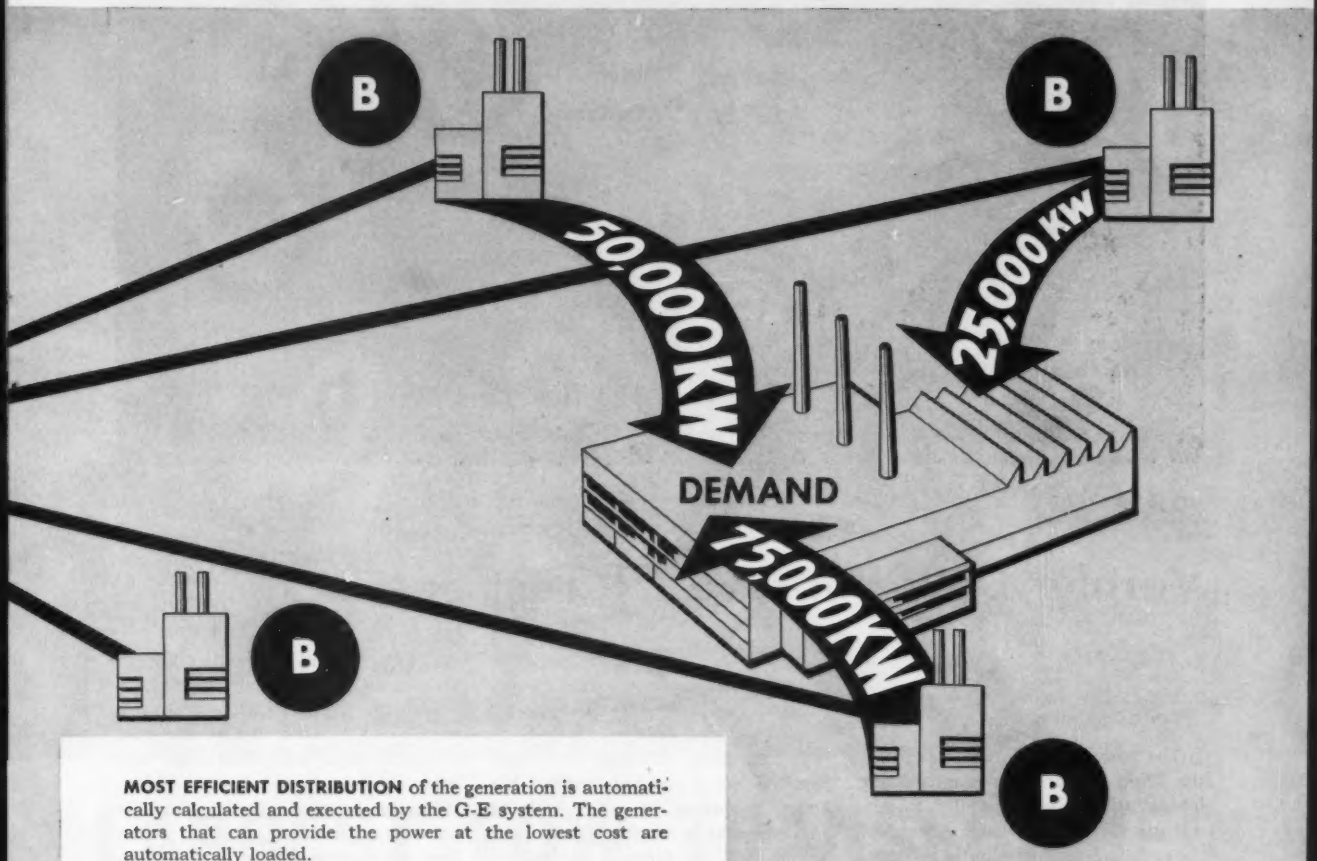


MASTER STATION AND MACHINE CONSOLE

AT THE AREA DISPATCHER'S OFFICE is located the master area and dispatching console. The master area console section develops the signal for the operating area. The dispatching section modifies this signal for each station to consider transmission losses.

AT THE STATION is located the master station and machine console. The master section provides all the adjustments for controlling the entire station. Controls for two machines, including incremental cost curve settings, are provided in each machine console section.

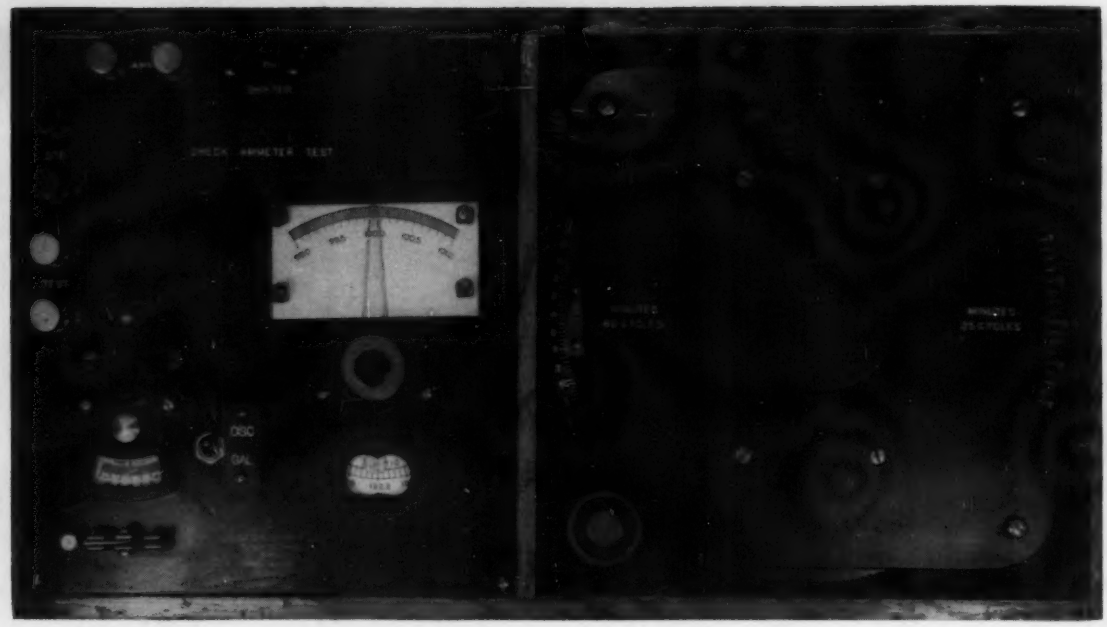
DISPATCHING SYSTEM



MOST EFFICIENT DISTRIBUTION of the generation is automatically calculated and executed by the G-E system. The generators that can provide the power at the lowest cost are automatically loaded.

KEY BENEFITS OF G-E SYSTEM

1. Most economical schedule is automatically computed and executed based on loading at equal incremental cost
2. Completely eliminates the need for detailed loading schedules
3. Addition or removal of machines does not require any readjustment of control equipment
4. Only one channel is required to control each generating station, thus relieving communication facilities
5. Transmission-loss penalty factors are easily applied to each station manually
6. No recorders are required as an integral part of the G-E automatic dispatching system
7. Panel space is not required because all components are mounted in consoles
8. Continuous and synchronized control is provided by the use of a highly accurate selsyn system



METERING—Testing

Vernier Dials Improve CT Test Set

R. F. RANDELS, Senior Meter Engineer, Standardizing Laboratory,
D. E. CASSIDY, Engineer Assistant A, Ohio Power Co, Canton, Ohio

The current transformer test set at the Ohio Power Co's standardizing laboratory has been modified to permit use of an oscilloscope instead of the usual galvanometer in the differential circuit. Accuracy and sensitivity were thus greatly improved.

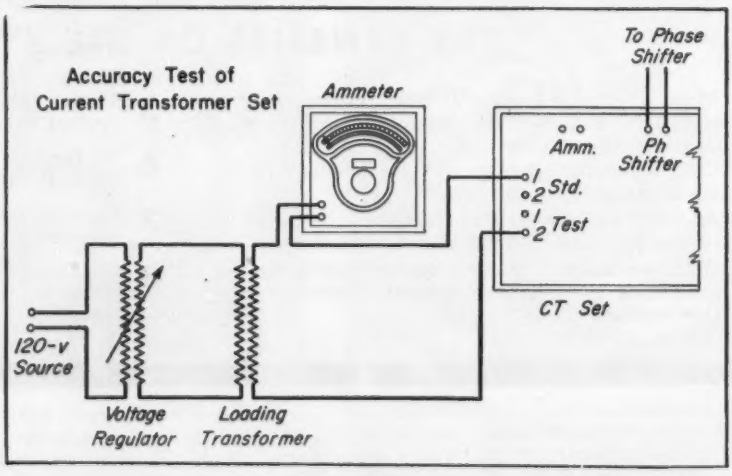
To obtain the greatest benefit from the increased sensitivity, vernier dials were installed on the ratio and phase-angle adjustments. The set was then checked against standard and test circuits.

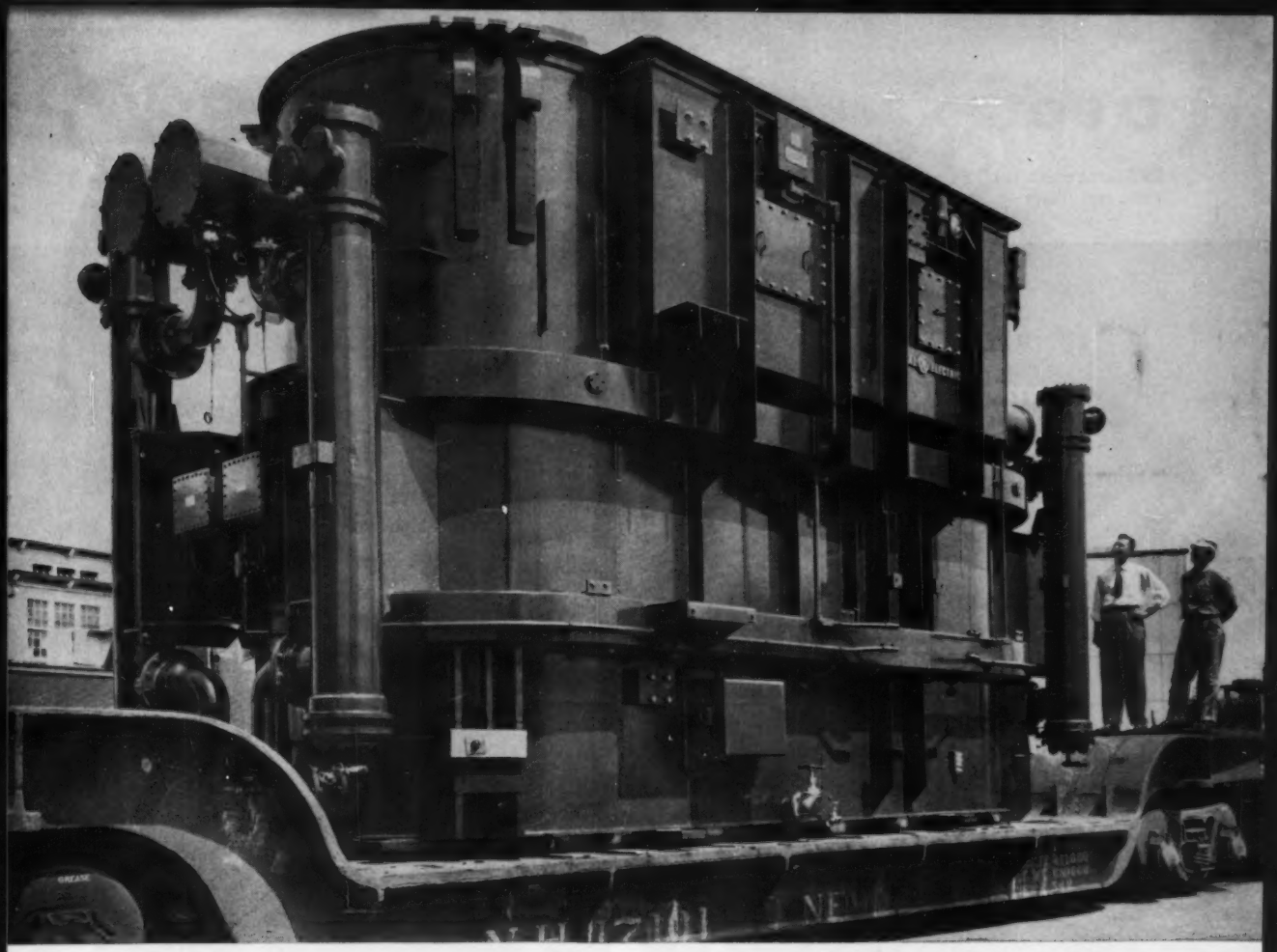
While the set was being modified, the ratio knob was replaced with a radio vernier dial of a type that can be purchased at any radio store for about $2. An expanded scale was drawn with a range from 99 to 101% only, the smallest divisions being 0.02%. This scale can be easily read to an accuracy of 0.01% with a magnifying glass corrected for parallax.

The phase-angle dial was equipped with a vernier scale and friction drive whose ¼-in. shaft was mounted in the holes occupied by the lower left-hand mounting stud which was removed. The friction drive consists of a ½- by 1-¼ in. (dia) rubber grommet which engages with the outside edge of the phase-angle dial and is actuated by the knob.

In checking accuracy, standard terminal No. 1 and test terminal No. 2 are connected in series with an ammeter and a loading device, and 5 amp are put through the circuit. With the same current through the test and standard circuits, the differential current is zero. The circuit is then balanced in the same manner as during the testing of a current transformer. The ratio dial should read 100.00% and the phase-angle dial zero. If they do not, a slight adjustment can be made on the slide-wire contacts on the ratio dial, and a new zero index can be made for the phase-angle dial.

(*More How To on page* 148)





LARGEST FOW TRANSFORMER PROVIDES IMPORTANT SAVINGS

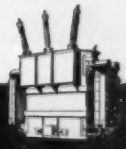
A midwestern utility realized important savings when it purchased this General Electric 275,000-kva, 132-kv, FOW (Forced-Oil-Water-Cooled) power transformer. Shipped late last year, this unit is believed to be the largest of its type ever built.

The savings were:

1) Reduced first cost. The price of this FOW transformer was less than that of like-rated units with any other type of cooling. The total annual cost, including the evaluation of losses, is also lower.

2) Reduced installation cost. All cooling equipment was shipped in place. Only moving to site, oil filling, plus installation of water connections and bushings were necessary before energizing. Upright shipment in a one-piece tank speeded handling.

Where adequate water exists, the economics point to increased use of FOW transformers. For further information on these units, contact your G-E Apparatus Sales representative or write to Section 421-38, General Electric Company, Schenectady 5, N. Y.



Power Transformer NEWS

Progress Is Our Most Important Product

GENERAL ELECTRIC

old

Ball-point contacts hit on only one spot. Can result in pitting, wear, corrosion—and possible overheating.

new

"V"-wedge contacts line up solidly, both sides . . . make for a high-pressure, multi-point, low-resistance contact.

ALL-NEW ENCLOSED FUSE CUTOUTS

now...

Self-aligning 'V'-wedge contacts have multi-point contact surfaces, add years to cutout life

Cutout life is extended in General Electric's all-new Enclosed Fuse Cutout line because of this unique construction which gives positive high-pressure, multi-point, low-resistance contact. In addition, these exclusive "V"-wedge contacts are free-floating and self-aligning—to assure you of positive contact every time. Broad surfaces of contacts are silver plated to protect against corrosion and maintain low resistance.

EVEN AFTER YEARS OF SERVICE, the faces of these "V"-wedge contacts stay bright, clean, shiny. Resistance is kept low—and cumulative overheating doesn't even get a chance to cause an outage.

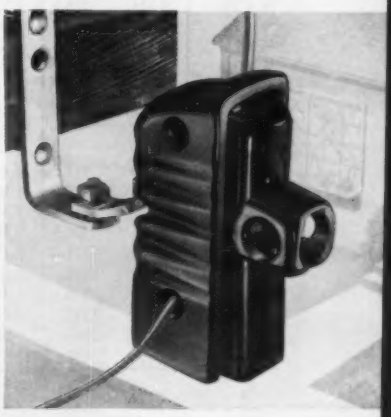
In old-style contacts, pitting, arcing and overheating could result from single-point contact—G.E.'s completely new "V"-wedge contacts eliminate these difficulties.

EVERYTHING IN ONE LINE—G.E.'s new Fuse Cutout line gives you all functions—indicating-dropout, indicating-non-dropout, disconnect—in one basic design. You get two current ratings, 50 and 100 amperes, and two voltage ratings, 5.2 and 7.8 kva, to match every possible system demand.

LINEMEN WILL LIKE the other new features of the new G-E Fuse Cutout line. The safety-grip door handle, for instance, that ends switch-stick juggling—and the unique plastic-to-metal latching that prevents door "freezing." In addition, fusing and line connecting have been made extra easy for fastest possible installation and servicing. For a complete description of the new cutout line, write for Bulletin GEA-6208, General Electric Company, Section 433-13, Schenectady 5, New York.

THIS NEW G-E FUSE CUTOUT

has all the features most engineers and linemen prefer. Logically so, too—hundreds of reports of the features they wanted were collected and evaluated. Their best ideas were incorporated into the new cutout design.



Progress Is Our Most Important Product

GENERAL ELECTRIC

Rectangular Copper Bus: Properties, Ratings

Data apply to rectangular hard-drawn copper bus bars. Material is adapted from a book on electrical conductors to be issued by The American Brass Co.

Size, In.	Cross-Sectional Area		Weight, per Foot Lb.	About X-X Axis			About Y-Y Axis			D-C Resistance, Microhms per Foot at 20 C, Max. (a)	Skin Effect Ratio (b)	60-Cycle Current Rating, Amperes (c)
	Sq. In.	Cir. Mils, Thousands		Moment of Inertia, In.^{4}	Section Modulus, In.^{3}	Radius of Gyration, In.	Moment of Inertia, In.^{4}	Section Modulus, In.^{3}	Radius of Gyration, In.			
⅛ x ½	0.0625	79.6	0.2415	0.001302	0.005208	0.1443	0.00008138	0.001302	0.03608	133.8	1.00	140
⅛ x ⅝	0.0781	99.5	0.3019	0.002543	0.008138	0.1804	0.0001017	0.001628	0.03608	107.0	1.00	160
⅛ x ¾	0.0938	119.4	0.3623	0.004395	0.01172	0.2165	0.0001221	0.001953	0.03608	89.20	1.00	190
⅛ x ⅞	0.1094	139.3	0.4226	0.006978	0.01595	0.2526	0.0001424	0.002279	0.03608	76.46	1.00	220
⅛ x 1	0.125	159.2	0.4830	0.01042	0.02083	0.2887	0.0001628	0.002604	0.03608	66.90	1.01	240
⅛ x 1½	0.1875	238.7	0.7245	0.03516	0.04688	0.4330	0.0002441	0.003906	0.03608	44.60	1.01	340
⅛ x 2	0.25	318.3	0.9660	0.08333	0.08333	0.5774	0.0003255	0.005208	0.03608	33.45	1.01	440
⅛ x 2½	0.3125	397.9	1.208	0.1628	0.1302	0.7217	0.0004069	0.006510	0.03608	26.76	1.02	530
¼ x ½	0.125	159.2	0.4830	0.002604	0.01042	0.1443	0.0006510	0.005208	0.07217	66.90	1.01	210
¼ x ¾	0.1875	238.7	0.7245	0.008789	0.02344	0.2165	0.0009766	0.007813	0.07217	44.60	1.01	290
¼ x 1	0.25	318.3	0.9660	0.02083	0.04167	0.2887	0.001302	0.01042	0.07217	33.45	1.01	360
¼ x 1¼	0.3125	397.9	1.208	0.04069	0.06510	0.3608	0.001628	0.01302	0.07217	26.76	1.02	430
¼ x 1½	0.375	477.5	1.449	0.07031	0.09375	0.4330	0.001953	0.01563	0.07217	22.30	1.03	500
¼ x 1¾	0.4375	557.0	1.691	0.1117	0.1276	0.5052	0.002279	0.01823	0.07217	19.11	1.03	560
¼ x 2	0.5	636.6	1.932	0.1667	0.1667	0.5774	0.002604	0.02083	0.07217	16.73	1.04	630
¼ x 2½	0.625	795.8	2.415	0.3255	0.2604	0.7217	0.003255	0.02604	0.07217	13.38	1.06	750
¼ x 3	0.75	954.9	2.898	0.5625	0.3750	0.8660	0.003906	0.03125	0.07217	11.15	1.09	860
¼ x 3½	0.875	1114.	3.381	0.8932	0.5104	1.010	0.004557	0.03646	0.07217	9.56	1.10	990
¼ x 4	1.	1273	3.864	1.333	0.6667	1.155	0.005208	0.04167	0.07217	8.36	1.12	1100
¼ x 5	1.25	1592.	4.830	2.604	1.042	1.443	0.006510	0.05208	0.07217	6.69	1.16	1310
¼ x 6	1.5	1910.	5.796	4.500	1.500	1.732	0.007813	0.06250	0.07217	5.58	1.18	1520
⅜ x ¾	0.2813	358.1	1.087	0.01318	0.03516	0.2165	0.003296	0.01758	0.1083	29.73	1.02	370
⅜ x 1	0.375	477.5	1.449	0.03125	0.06250	0.2887	0.004395	0.02344	0.1083	22.30	1.03	460
⅜ x 1¼	0.4688	596.8	1.811	0.06104	0.09766	0.3608	0.005493	0.02930	0.1083	17.84	1.04	540
⅜ x 1½	0.5625	716.2	2.174	0.1055	0.1406	0.4330	0.006592	0.03516	0.1083	14.87	1.05	620
⅜ x 1¾	0.6563	835.6	2.536	0.1675	0.1914	0.5052	0.007690	0.04102	0.1083	12.74	1.06	700
⅜ x 2	0.75	954.9	2.898	0.2500	0.2500	0.5774	0.008789	0.04688	0.1083	11.15	1.09	770
⅜ x 2½	0.9375	1194.	3.623	0.4883	0.3906	0.7217	0.01099	0.05859	0.1083	8.92	1.12	920
⅜ x 3	1.125	1432.	4.347	0.8438	0.5625	0.8660	0.01318	0.07031	0.1083	7.43	1.14	1060
⅜ x 4	1.5	1910.	5.796	2.000	1.000	1.155	0.01758	0.09375	0.1083	5.58	1.19	1320
⅜ x 5	1.875	2387.	7.245	3.906	1.563	1.443	0.02197	0.1172	0.1083	4.41	1.24	1580
⅜ x 6	2.25	2865.	8.694	6.750	2.250	1.732	0.02637	0.1406	0.1083	3.68	1.28	1820
½ x ¾	0.375	477.5	1.449	0.01758	0.04688	0.2165	0.007813	0.03125	0.1443	22.07	1.03	450
½ x 1	0.5	636.6	1.932	0.04167	0.08333	0.2887	0.01042	0.04167	0.1443	16.56	1.05	550
½ x 1¼	0.625	795.8	2.415	0.08138	0.1302	0.3608	0.01302	0.05208	0.1443	13.24	1.06	650
½ x 1½	0.75	954.9	2.898	0.1406	0.1875	0.4330	0.01563	0.06250	0.1443	11.04	1.09	740
½ x 2	1.	1273.	3.864	0.3333	0.3333	0.5774	0.02083	0.08333	0.1443	8.28	1.13	900
½ x 2½	1.25	1592.	4.830	0.6510	0.5208	0.7217	0.02604	0.1042	0.1443	6.62	1.16	1070
½ x 3	1.5	1910.	5.796	1.125	0.7500	0.8660	0.03125	0.1250	0.1443	5.52	1.18	1230
½ x 4	2.	2546	7.728	2.667	1.333	1.155	0.04167	0.1667	0.1443	4.14	1.26	1510
½ x 5	2.5	3183.	9.660	5.208	2.083	1.443	0.05208	0.2083	0.1443	3.31	1.31	1790
½ x 6	3.	3820.	11.59	9.000	3.000	1.732	0.06250	0.2500	0.1443	2.76	1.36	2060

NOTES: Variations from these values must be expected in practice. ASTM Standard Specification B 187, Copper Bus Bar, Rod and Shapes, controls all dimensions, tolerances, tensile properties, tests and inspection.

(a) Dc resistivity is that for hard bars per ASTM B 187. Sizes up to ⅜ in. x 4 in. inclusive correspond to conductivity of 97.4% IACS minimum; sizes over ⅜ in. x 4 in., and over ⅜ in. thick any width, correspond to 98.4% IACS minimum. All soft bars will have resistivities corresponding to 100% IACS minimum.

(b) Skin-effect ratio at 60 cycles per second.

(c) 60-cycle current-carrying-capacity ratings were computed for a 30 C temperature rise over still air at 40 C, bright surface, the conductor horizontal, on edge and free from all outside magnetic influences. Except for installations that must conform to the latest edition of the National Electrical Code, National Board of Fire Underwriters, ac ratings for single bars may be used for dc installations using those rectangular sizes having skin-effect ratios of 1.00 to 1.02. Dc ratings may be adjusted upward in proportion to the square root of the skin-effect ratio for other sizes. There is no loss of dc current-carrying capacity comparable to skin effect in conductors made up of two or more closely spaced parallel rectangular bars in well ventilated locations.

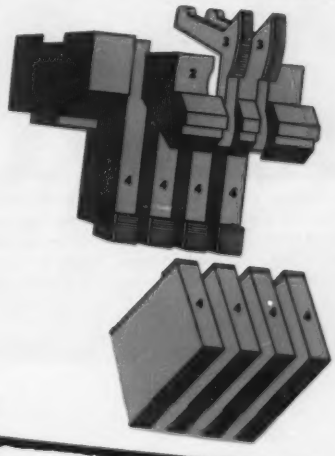
G-E Type AK-1-50 Electrically Operated Air Circuit Breaker, 1600-amperes, 600 Volts, A-C. One pole shown. Made by General Electric Company, Low Voltage Switchgear Department, 6901 Elmwood Ave., Philadelphia, Pa.

Here is the General Electric Type AK-1-50 Electrically Operated Air Circuit Breaker, 1600-ampere frame size used to protect low-voltage systems. The picture shows one pole of the contact, and in order to photograph it, the housing and the arc-quencher parts were removed. Note the Revere Extruded Shapes, and Rectangular Rod. There are three shapes, and one size of bar, all in copper, because copper has the highest electrical conductivity of all commercial metals.

If these shapes had to be "hogged" out of bar, they would be expensive, due to the machining time, and the scrap generated. While copper scrap is readily salable at good prices, it is costly from the machining standpoint. Extruded shapes by Revere, preformed to the desired contours, usually reduce machining to a cutting-off operation, plus such minor details as drilling which cannot be done during extrusion. Shapes naturally cost more per pound than bar or rod, but the ultimate saving makes up for the difference and more, sometimes several times.

Are you doing much machining of copper? If so, look into Revere Extruded Shapes. They may save money, and speed up production as well. See the nearest Revere Sales Office.

Sketch showing details of contacts. Nos. 1, 2 and 3 are extruded and drawn copper shapes. No. 4 is rectangular copper bar. Cross hatching represents special arcing contacts brazed to the copper.



REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

• • •

Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y. —Sales Offices in Principal Cities, Distributors Everywhere

For a Really Safe

It takes 3 tanks

Even a Small Outdoor Breaker should have Tank-Per-Phase Construction

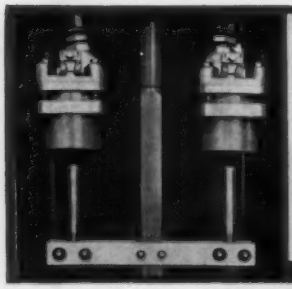
Don't be ⅓ safe! It costs you no more to get the complete safety of 3-tank breakers.

Compare this breaker with others of the same rating, and see the difference. Here's a small outdoor breaker built with big breaker features:

- Tank-per-phase construction completely isolates phases to eliminate internal phase-to-phase flashover.
- Two vertical breaks per phase with time-proved, fully tested *Ruptor* interrupting devices.
- Roomy operator cabinet with side-hinged L-shaped doors for maximum accessibility.

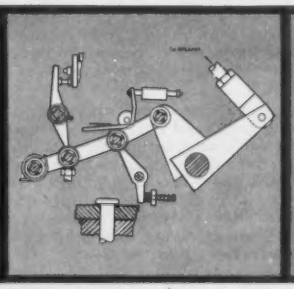
There is no other breaker for 14.4 and 23-kv service that compares with this breaker for safety, ease of maintenance and overall accessibility. It's *quality* throughout.

GET INFORMATION and make your own comparison. Call your nearby A-C office, or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin. A-4933

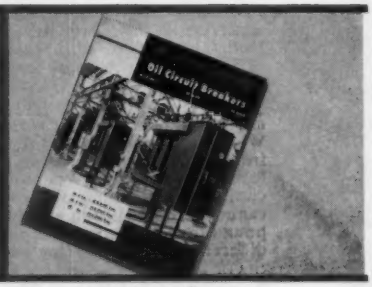


Two vertical internal breaks per phase . . . features time-proved, fully tested *Ruptor* interrupting devices with self-wiping, self-aligning tulip and bayonet contacts.

No buried leads. No more conduits . . . no dropping of breaker tanks to get at bushing current transformer leads. Simply remove bottom cover plate of fabricated wiring duct.



Four-bar linkage like ones on large A-C breakers provides mechanically trip-free operation. Simple solenoid operator — factory-set shim adjustments cut maintenance.



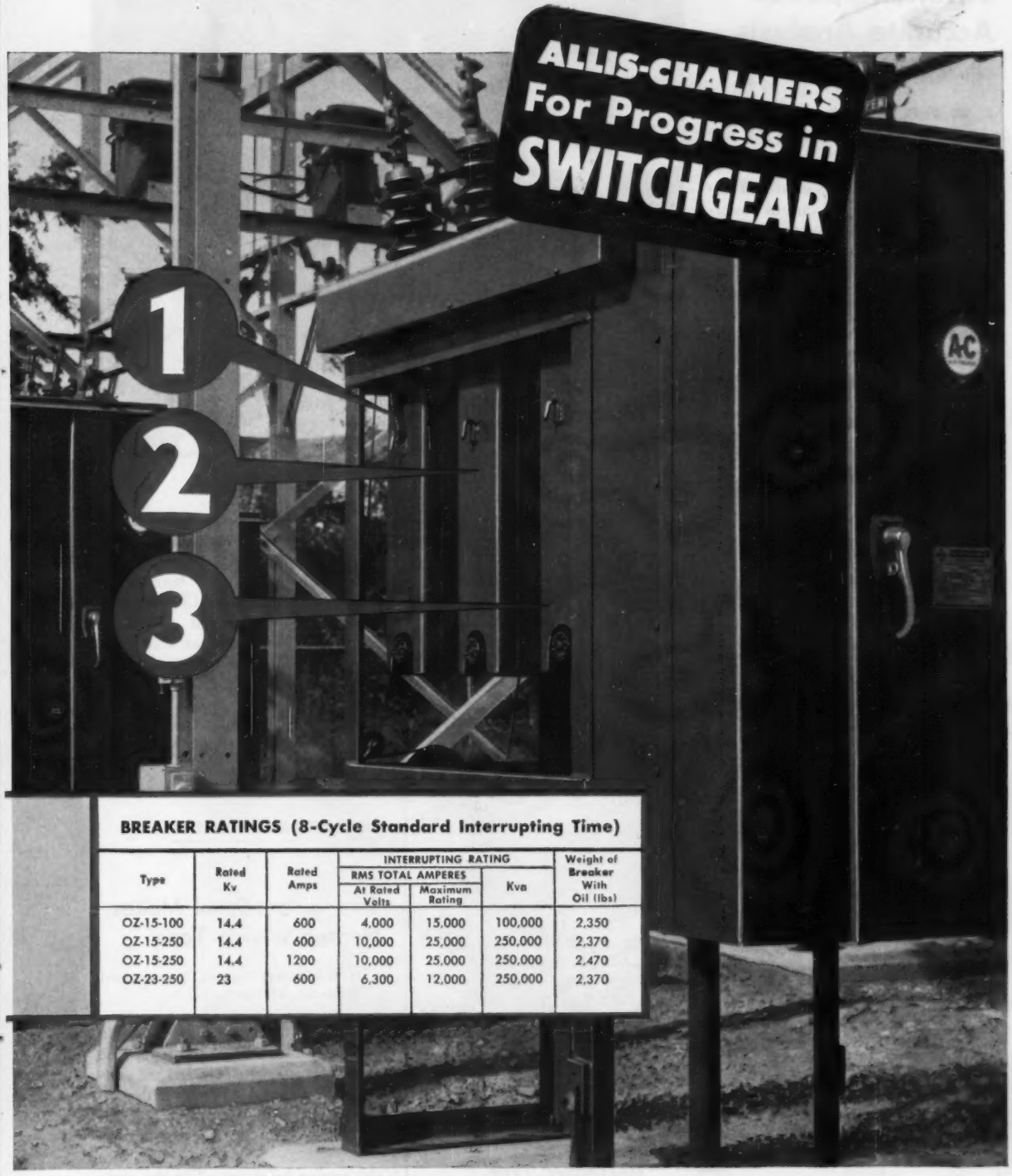
Eight-page bulletin 71B7946 tells the complete story. It shows the many quality features ordinarily found only in the larger breakers built into these units.

Ruptor is an Allis-Chalmers trademark.

A-C ALLIS-CHALMERS

ALLIS-

Distribution Breaker . . .



BREAKER RATINGS (8-Cycle Standard Interrupting Time)

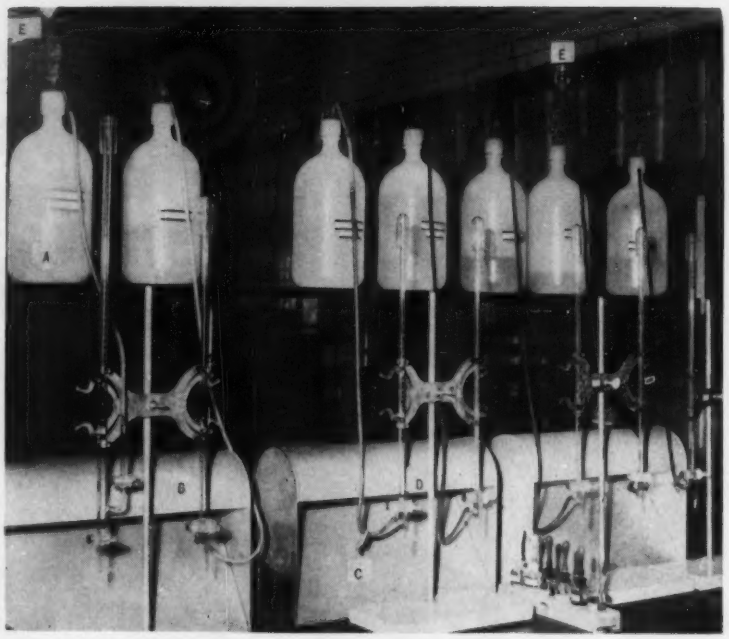
Type	Rated Kv	Rated Amps	INTERRUPTING RATING			Weight of Breaker With Oil (lbs)
			RMS TOTAL AMPERES		Kva	
			At Rated Volts	Maximum Rating		
OZ-15-100	14.4	600	4,000	15,000	100,000	2,350
OZ-15-250	14.4	600	10,000	25,000	250,000	2,370
OZ-15-250	14.4	1200	10,000	25,000	250,000	2,470
OZ-23-250	23	600	6,300	12,000	250,000	2,370

CHALMERS

Semi-Automatic Titration Speeds Accurate Analysis

GENERATION—Operation

J. W. RUFF, Chief Chemist, Muskingum River Plant, Ohio Power Co, Beverly, Ohio



Muskingum River Plant of the Ohio Power Co has speeded and improved the accuracy of various power-plant water analyses by the installation of a semi-automatic titration assembly. By means of this assembly, analyses of treated water and all boiler water have been completed by a single operator in about one hour, actual time depending upon plant conditions.

Among the advantages of this titration assembly are the following:

1. Speed and accuracy. Too much time is wasted in laboratories using a single burette for different reagents. The burette must be washed and the reagents slowly poured into it from bottles. When this time is saved, it easily offsets the additional expense of 3-way burettes.

2. Marked saving of reagents. In using this assembly, the chemicals are stored in 4-liter polyethylene bottles, so that reagents are never unnecessarily exposed to the air. Where necessary, chemicals are protected by thistle tubes and chemical gas traps.

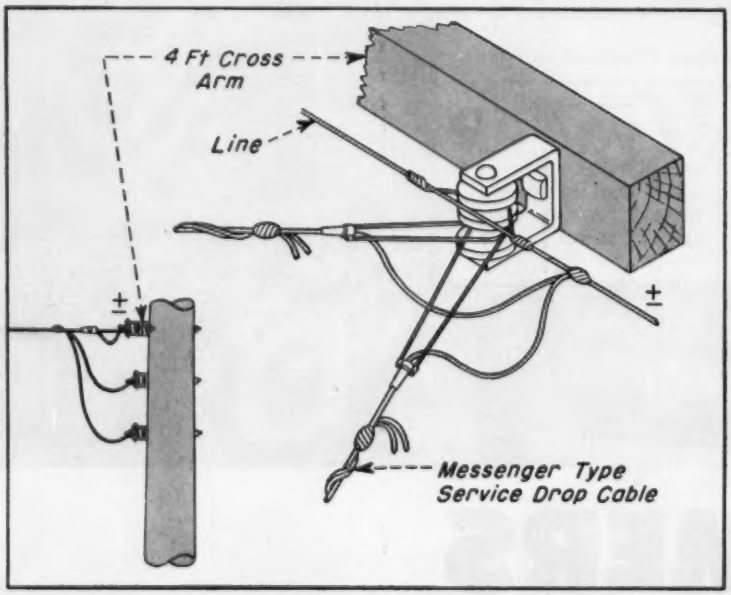
3. Speedy, accurate filling of burettes avoids wasting reagents. Three-way stopcocks are not awkward to use after practice. When the assembly is not in use, stopcock leakage is prevented by clamps on rubber hose.

4. Cleanliness of burettes. Each reagent has its own burette, so that contamination of glassware is avoided. Contamination of the hose is prevented by selection of proper plastic or rubber hose for each analysis.

5. Less chance of wrong chemicals. When only one or two burettes are used and filled as needed from a shelf of bottles, they present a frequent source of error and annoyance.

6. Assembly-line procedure. The water analyses are handled in an orderly, effective manner.

7. Neat, presentable appearance.



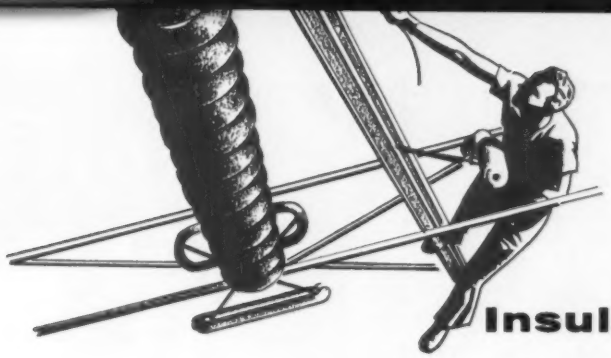
DISTRIBUTION—Construction

Two-Groove Spool Makes Neater Service Taps

E. H. HAGBERG, Engineer, Commonwealth Edison Co, Chicago

Use of the two-groove spool insulator has resulted in the separation of the secondary line tap and the service wires on the Commonwealth Edison Co system.

Use of this device has produced a neater job than where the line wire and service wires are all in the same groove and it makes it easier to install additional services or to remove services.



Re-Shaped Fields Cut Insulation Expense On 345-kv Line

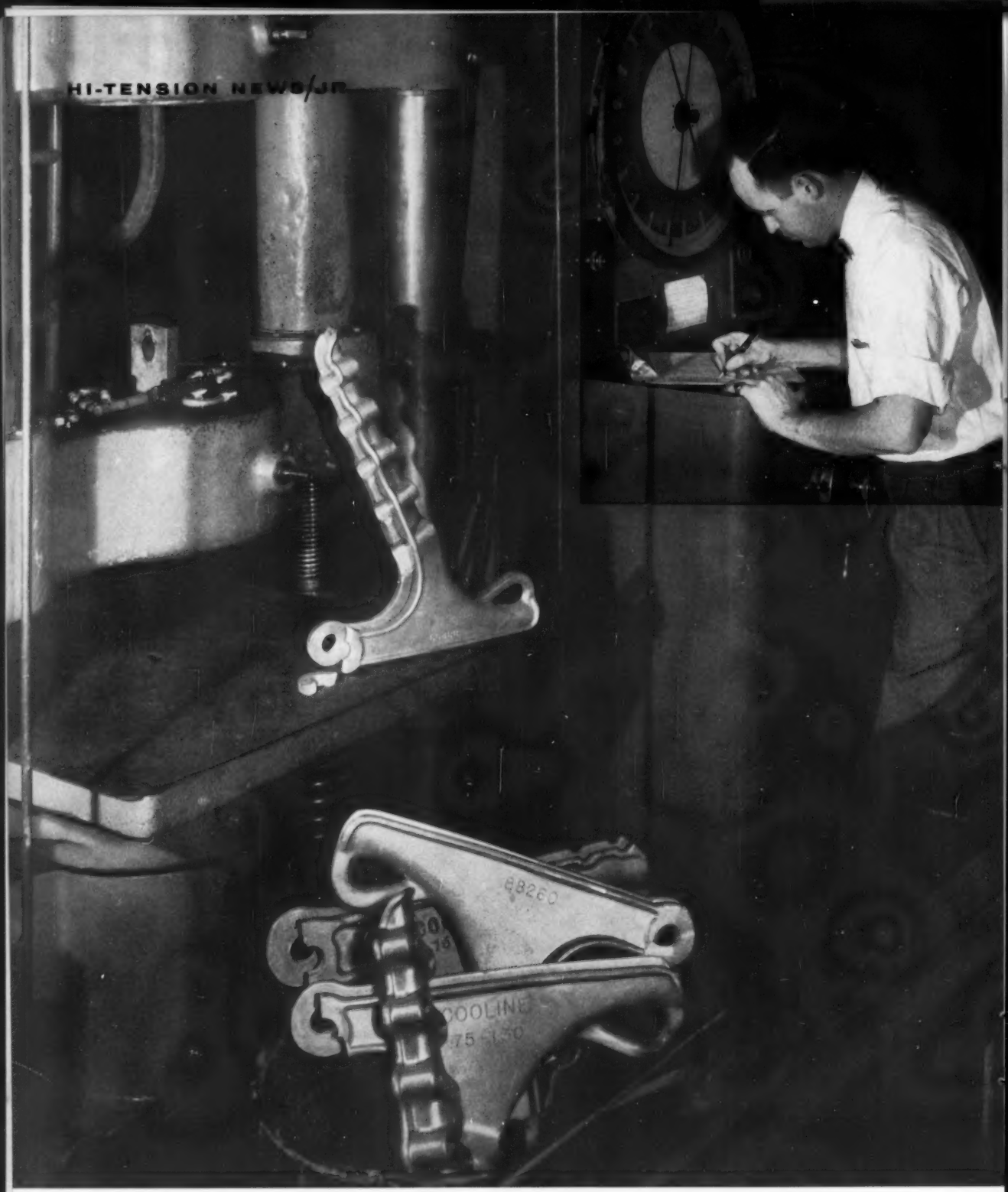
O-B Control Rings redistribute electrical stress; permit use of standard hardware on extra-high voltage transmission line.

O-B knowledge of shield devices and their effect on the distribution of electrostatic stress forestalled expensive, time-consuming hardware development for this 345-kv transmission project. Thanks to a rich background in corona research, our engineers already knew *how* to design and evaluate shield rings when Ohio Brass Company was given the job of supplying materials for this line. After redistribution of electrostatic stress by proper ring design, it was possible for the builder to use conventional O-B suspension hardware and insulator designs.

Among the suppliers of materials for extra-high voltage transmission lines, *only Ohio Brass Company manufactures both insulators and hardware:* Ohio Brass Company maintains a high-voltage laboratory in which the design of both classes of product can be studied, separately and in combination. Research guiding, and then applied to, the design of these materials assures every O-B user of the best in every combination of insulating materials!

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Ohio Brass



Data from current strength tests is compared with the statistical history of previously-tested clamps. Records kept for years and years give us a statistically reliable background against which to evaluate current production. Here the investigator is writing down the latest episode in our "History of Broken Clamps!"

Historian at Work

This technician is making and recording history of a peculiar sort -- a history of broken clamps! Several times each week he breaks a group of clamps taken at random from daily production, and enters their laboratory performance in a years-old record of the performance of similar clamps.

Such a record is invaluable to Ohio Brass Company. We know the service O-B clamps have given in the field for years (it's excellent!), and from the record we know how samples of these clamps tested in the laboratory. Statistically, then, minimum performance of the clamps we make each day can be predicted after testing only a few.

Once in a while, daily records show that ultimate strengths, while still well above their rated strength, are lower than we'd like. Signals like that give us a chance to "spruce up" production methods; to nip potential trouble in the bud.

And very infrequently, the testing shows up a questionable batch of clamps -- a batch that is taken out of production and scrapped. Rather than take a chance, we prefer to scrap questionable hardware.

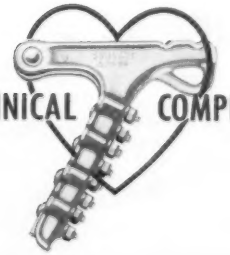
Test samples of clamps (and other O-B hardware, for that matter) meet their end by well-defined methods. A card file, kept handy at the test machine, lists specific jigs and fixtures to hold every size of O-B clamp as it is pulled. These tools of destruction deliberately load the hardware more severely than the tugs and strains of field service. Further, use of the same test methods year in and year out gives us results gathered in a consistent manner; allows us to make meaningful comparisons.

Breaking clamps, and profiting by what we learn from the broken bodies, is one phase of the Technical Competence concept followed throughout the O-B organization.

OHIO BRASS COMPANY, MANSFIELD, OHIO
In Canada—Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.

Given a reliable statistical background for comparison, it is not necessary to break many clamps in order to judge the strength of the entire lot. Six or a dozen units are all that are required. Over a period of years, however, this adds up to a lot of clamps. In fact, we've busted $30,000 worth in the past five years!

Extremely important is the O-B system of "planned destruction." It is not enough to maintain a consistent program of breaking clamps and recording strengths; it is also necessary to make sure that the *method* for breaking remains constant, so that results will be comparable. Cards list the specific pins, clevises, and fittings to use on every piece of hardware submitted for strength tests!



TECHNICAL COMPETENCE the heart of every Ohio Brass clamp

How're Ya Going To Keep Things Up On The Farm

. . . unless there's enough distribution? Today the "average farmer" uses about 700 kw-hr a year for production work; and about three times that much in his home. Informed guessers say that the "average farmer," ten years hence, will be using a little more than ten times as much -- perhaps 30,000 kw-hr -- each year!

Most of it, quite likely, will be brought in on rural distribution lines IF THEY GROW AS FAST OR FASTER than the predicted use. Otherwise the bright electrical future will be a wistful thought if line capacity doesn't keep pace.

As you look ahead to possible increases on your rural load -- the egg washers and wash dryers, the hay dryers and dish washers -- remember that Graybar is a willing, competent partner in any line-building program. Graybar will stock what you need, hold it, and deliver at the time and place you choose. Ohio Brass Insulators, and related line hardware, are stocked by Graybar for applications as high as 23 kv.

OHIO BRASS COMPANY, MANSFIELD, OHIO

Ohio Brass

GraybaR QUALITY SINCE 1869 *REG. U.S. PAT. OFF. Distributed by GraybaR ELECTRIC COMPANY

4663-H

Plastic and Electricity Make Baby Bottle Kit

Here's a product that might not exist if electric power were unavailable . . .

D. E. DOME, Industrial Power Engineer, Ohio Power Co, Newark, Ohio

A disposable plastic baby feeding kit now being made by Shellmar Betner Div of the Continental Can Co, Newark, Ohio, depends heavily upon electricity during its manufacture.

From initial extrusion of polyethylene films for the bottles to final packaging of the assembled kit, all critical factors are governed by electricity.

Rod-type metal sheath heaters are used in the extrusion equipment, which can produce tubular films from 1½-in. diam to 36-in. diam. The larger sizes are made into bags. Connected load of these machines varies from 5.5 kw to 25 kw.

A 5-ton air conditioner serves the area in which the extruded film is processed. It controls both temperature and humidity. An air purifier coupled to the air conditioner adds another degree of sanitation. This area is restricted to selected employees.

In addition, the room's walls are dotted with 15-w germicidal lamps which fight air-borne germs. Thirty-watt germicidal lamps in packaging machines assure complete sanitation of the product.

The tubular bottle material is inspected electronically for defects. When a flaw is revealed, a 375-w cutter removes the damaged section and splices the material. This is done at 375F.

Because of the nature of this product, it is thought that such a baby feeding kit could not be made if electricity were not available.

TUBULAR HEATERS ring extrusion barrel of machine producing plastic film

ELECTRONIC inspector whacks out bad sections of film at 375F, then splices

GERMICIDAL lamps help keep manufacturing areas sanitary for baby bottles

Far-Infrared Oven Dries Printed Color Cards Fast

CLARK B. NEWELL, Consultant, Business Development Dept, Utah Power & Light Co, Salt Lake City, Utah

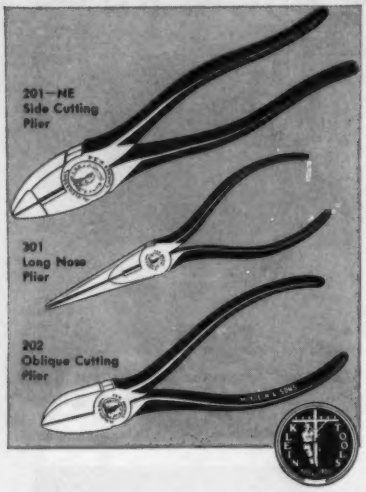
Better quality color printed cards, plus a bonus of time and labor saved, result from the installation of a new 30-kw electric oven at R. W. Marsh & Son, Salt Lake City. The unit is used in the silk-screen printing process in which up to six colors applied per card must be dried before the next is applied.

In 1943, a 7x40-ft electric oven, using a combination of strip heaters and infrared lamps, was installed in the plant. This oven partially solved the drying problem but heat-up time and floor space occupied by the oven were excessive.

When the company moved to a new location in 1954, a 7x20-ft oven was designed that saved 50% in floor space. A variable-speed conveyor carries the cards through the oven for each drying cycle. Mounted 18 in. above the conveyor in the hood of the oven are 12 far-infrared 2.5-kw heaters. An exhaust fan in the stack moves 4,000 cfm of air to remove fumes from the drying ink.

Cards are dried in about 42 sec after which they may be printed with another color or stacked immediately. The oven operates for about 60 cents/hr and requires no heat-up time.

KLEINS



Standard of the Industry for Nearly a Century

Ask the lineman on the pole . . . the electrician at the switchboard. They will tell you that the pliers they rely on are Kleins—every time.

Kleins have been serving the electrical industry since the first wires were strung and today have the same high quality, the same fine craftsmanship, the same individual inspection and testing that have won them their place for a century as first in pliers.

A wide variety of sizes and styles to meet any need . . . but only one quality—the highest.

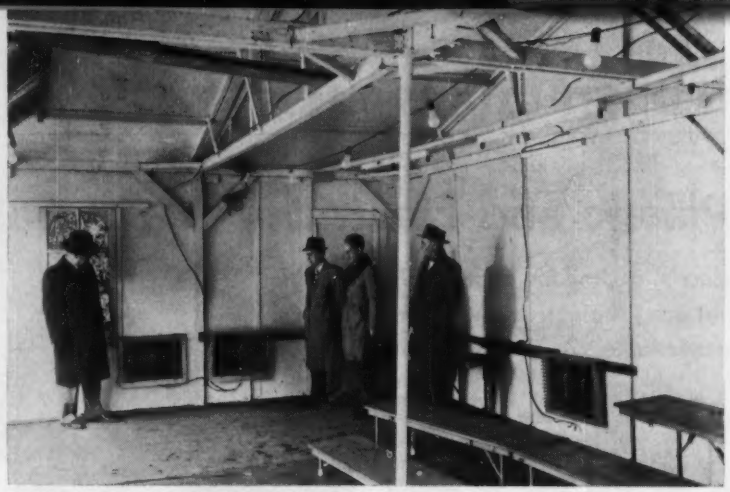
ASK YOUR SUPPLIER

Foreign Distributor:
International Standard Electric Corp.
New York

New Plier Display

Speed up Klein Plier sales with this new display board. Write for price and full information.

Mathias KLEIN & Sons
Established 1857 — Chicago 45, Illinois
7200 McCORMICK ROAD • CHICAGO 45, ILLINOIS



TEN HEATERS WARMED SINGERS WELL in an open-front stage during programs of Christmas music in Indianapolis. The units overcame an undervoltage handicap

Photos by Berko Electric Mfg Corp.

More Applications **INDUSTRIAL**—Design

Radiant Heat Warms Singers

ALBERT L. MAILLARD, President and Managing Director, Electric League of Indianapolis, Inc, Indianapolis, Ind.

Singers and instrumentalists performing on a large open stage during Christmas festivities in Indianapolis were warmed by radiant heaters designed for 230 v, but connected to the available 208-v supply.

Situated in an elevated position at the base of a massive monument in Monument Circle, the plywood stage had one side completely exposed to bitter winter weather. Attempts to warm the air inside the stage would have been futile. However radiant heat could warm the performers, so it was selected.

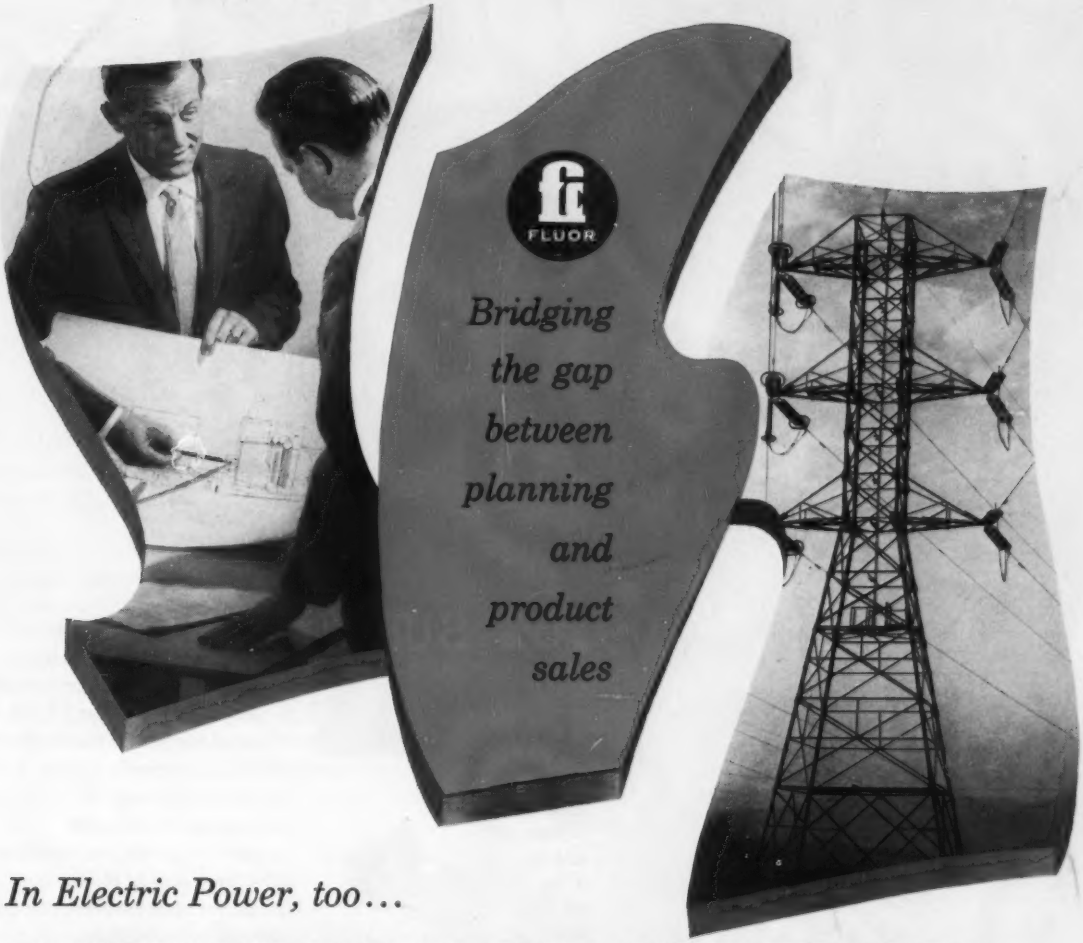
Ten 1,000-w units were chosen to heat the 20 x 30 x 10 ft structure. Six were put 2 ft above the floor on the three walls. Four were mounted above the stage opening and were tilted about 30 deg so their radiation would strike the performers.

Because of the unusual operating condition, no thermostat was used. It was fould that the stage area was comfortable during the day if heaters were turned on an hour before a scheduled performance, and if singers wore choir robes.

On the night of the opening ceremonies, the outdoor temperature dipped to 12F. A 20-mph wind blew from behind the stage. Choristers wore overcoats and felt comfortable. A man checking the heating system expressed surprise at his personal comfort because the undervoltage cut the heaters' efficiencies 20%.

The stage and its singers form part of the Indianapolis civic Christmas celebration supported on a non-commercial basis by indivdiuals and businesses in the area.

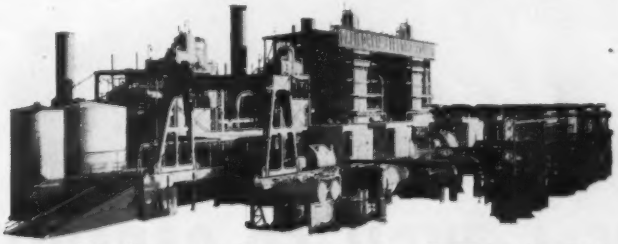
100-AMP SERVICE WAS PUT IN TO SERVE HEATERS, LIGHTS, AND PA SYSTEM



In Electric Power, too...

FLUOR TURNS PLANS INTO PROFITS

Start with nothing but a description of the task ... then let Fluor do the rest. In California Electric Power's new Highgrove Steam Plant, for example, Fluor services extended from initial economic studies to completion of one of the nation's most modern generating facilities, and the design represents the latest in economical, "outdoor" power-plant engineering. The experience at Highgrove ... early completion, construction for less than estimated cost, efficiencies better than originally estimated ... is typical of Fluor's record. Similar experience throughout the power industry ... and in petroleum refining, chemical and petrochemical production and fertilizer manufacturing ... is the reason more and more companies are finding that you *can* be sure with Fluor.



The Highgrove, Calif., Steam Plant started at 60,000 KW, was later expanded to a total of 140,000 KW... a new 60,000 KW plant for the same power company is now being constructed at San Bernardino, Calif., by the Fluor Corporation.

Engineers • Constructors

The FLUOR CORPORATION, Ltd. **FLUOR**

2500 So. Atlantic Blvd., Los Angeles 22, Calif. • Offices in Principal Cities in the United States and Canada

Imagine the wrath of this boy . . . and thousands of others in his community . . . if power outages cut off the TV at the "crucial moment". That's where C-D's field-proved dependability pays off . . . regardless of changing weather or power load conditions. The thousands of C-D power capacitor installations . . . all with records of better than 99.6% trouble-free service . . . have proven C-D BEST BY FIELD TEST in its contribution to the high continuity of utility service. Consult C-D to learn how you can get more for your capacitor dollars with C-D.

CORNELL-DUBILIER CAPACITORS

consistently dependable for power-factor improvement

PLANTS IN SO. PLAINFIELD, N. J.; NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS.; PROVIDENCE AND HOPE VALLEY, R. I.; INDIANAPOLIS, IND.; SANFORD AND FUQUAY SPRINGS, N. C.; SUBSIDIARY, RADIART CORP., CLEVELAND, OHIO

CORNELL-DUBILIER power-factor capacitors give you better than 99.6% trouble-free service*

Low dielectric unit stress provides an extra margin of safety that results in the ability to withstand higher transient voltages. When you buy C-D, you buy premium quality at no extra cost.

Extra strength wet process two piece porcelain terminals . . . one of the many important reasons why C-D capacitors can point to year after year of trouble-free service in coastal areas.

Another evidence of C-D's premium quality power capacitor service . . . at no extra cost . . . is the fact that C-D has no "Return Material Department". Most repairs are of such a minor nature that they are handled on an individual basis. This results in a prompt, personalized service impossible where the safety factor has been cut in favor of production, weight and size economies.

C-D's rack capacitors are shipped completely assembled ready for energization. Again C-D's conservative engineering standards provide the structural strength to do this and as a result save the utility time, assembly and installation costs in the field.

Why is it that only C-D power capacitors give you assurance of complete dependability?... because C-D's built-in safety factor results from the ultimate in tried and proven design levels coupled with conservative production techniques and rigorous quality control. For catalog write to Cornell-Dubilier Electric Corporation, South Plainfield, N. J.

Part of a 37,000 KVAR C-D installation at substations of a large Western company.

***This is an average based on reports from leading utilities using C-D capacitors. Many of these reports have shown 100% trouble-free service, and none lower than 98.9%.**

INDUSTRIAL BRIEFS

Cleaning metal tanks with live steam produced in a 22.5-kw electric steam generator is saving Harrisburg Upholstering Co, Highspire, Pa., money on a U. S. Government contract. Moreover, a dangerous condition has been eliminated, and the cleaning operation has been speeded considerably. The tanks, in which the armed forces will ship such things as airplane engines all over the world, formerly were cleaned by a solution heated by a kerosene burner. The electric installation does a better, safer job at less cost. Russel L. J. Heintzelman, Industrial Representative, Pennsylvania Power & Light Co, Harrisburg, Pa.

Warming oil wells with bottom-hole heaters is helping N. W. Curson Associates realize 100% to 300% more production from holes in the Placerita-Newhall area near Los Angeles. The firm has installed 18-kw and 30-kw heaters in heavy, low-gravity (from 9.8 to 15) wells. Energy for this increased production costs less than 10¢ per barrel. Paul H. Henrichs, Industrial Power Engineer, Southern California Edison Co, Los Angeles.

Heat treating steel without formation of scale is being done by Loud Machine Works, Pomona, Calif., in a 250-kw, 3-phase salt-bath furnace. The electric furnace permits temperature control within 5F for production of about 500 lb per hour. Paul H. Henrichs, Industrial Power Engineer, Southern California Edison Co, Los Angeles.

Finishing silk thread with an electric strip heater after immersion in a sizing solution results in an improved finish at Loma Weaving Co, Wrightsville, Pa. Drying equipment consists of 80 150-w, 24-in. strip heaters faced with stainless steel to reduce snagging. The sized silk thread is passed over the face of the heater twice before being wound on bobbins. To meet varying conditions of humidity, and temperature, the drying time is changed by an adjustable thread speed control. Forty dryers were changed from steam to electricity by machining a groove in the face of the steam unit and inserting a 150-w bottom-insulated strip heater. Harry Denison, Industrial Representative, Pennsylvania Power & Light Co, Lancaster, Pa.

Barn Cleaners: Sell Their Convenience and Low Operating Cost

SALES
Rural

Michigan study shows operating cost is less than a penny a month per animal. Farmer can save enough time and money to care for three more cattle

ROBERT L. MADDEX, Extension Agricultural Engineer, Michigan State University, East Lansing, Mich.

Cost of operating mechanical barn cleaners, or gutter cleaners as they are commonly called, was less than 1¢ per month for each animal in four Michigan stables where records were kept.

This 1¢ figure was the cost for ½ kwhr, the average monthly energy required to care for each animal. Costs were determined by placing electric meters for 12-month periods in barn cleaners installed.

Results Tabulated

Data compiled for the four farms studied are shown in Table I. They include costs for a year's operation, cost for the highest month of the year, kwhr used, average number of cows in each dairy stable, and the estimated tons of manure removed.

Cost per animal to operate the gutter cleaner for a year can be determined by dividing the number of dairy animals into the total operating costs for one year. Thus, the yearly cost per animal is 7.1¢ on Farm No. 1 (3.2 kwhr), 6.1¢ on Farm No. 2 (2.8 kwhr), 4.1¢ on Farm No. 3 (2.3 kwhr), and 4.0¢ on Farm No. 4 (1.9 kwhr). Part of this difference in cost is due to difference in electric power rates, and part to difference in use of the gutter cleaner during the warm months of the year.

Amount of time spent in removing manure from a dairy stable by hand will vary, but many farmers having 25 dairy animals will spend one hr a day or 365 hr a year. Where a mechanical barn cleaner does the task in ten min there is a saving in time of 50 min a day or 305 hr a year. Time required to care for a dairy animal in a stanchion barn ranges from 75 hr to 125 hr a year. Difference in time required depends upon the stanchion barn arrangement and the efficiency of the operator. Most dairy farmers will spend 90 to 100 hr per year caring for each animal.

On a dairy farm where 305 hr of labor a year could be saved by installing a gutter cleaner, more dairy animals could be added to the herd. On many farms three dairy animals could be cared for in the time saved. Figure it this way:

If the net return from each dairy animal was $150 a year, a total return of $450 could be added to the farm income. Installation costs of a commercially made barn cleaner run from $1,000 to $1,200. Charging 15% of the original investment for depreciation, interest on investment, and maintenance, the annual cost of a barn cleaner would be from $150 to $180 a year. Deducting this charge from the return of $450 leaves an increase of approximately $300. This income could be added without increasing the labor load of the farm.

The mechanical barn cleaner has proven to be inexpensive to operate. It makes the removal of manure much faster and much easier. When a barn cleaner is installed, the labor thus saved can be used in caring for more animals. Dairy profits go up.

(*More S & S on page* 160)

Table I — Operating Costs and Kwhr Consumed Mechanical Barn Cleaner

	Farm No. 1	Farm No. 2	Farm No. 3	Farm No. 4
Total Cost per Year	$2.70	$2.52	$1.45	$1.02
Total Kwhr per Year	120	112	83	46
Cost for Highest Month	.38	40	.21	.16
Kwhr for Highest Month	17	18	12	9
Average Number of Animals	38	41	35	25
Estimated Tons of Manure	300	310	260	270

IT'S SPRING LOADED . . . GIVES YOU EVERYTHING!

FARGO HOT LINE CLAMP

"AGE SERIES"

Bronze or plated bronze . . . aluminum or plated aluminum . . . you can have Fargo Hot Line Clamps for any combination of conductors! What's more, the "vise type" design with extra wide jaws gives superior conductor contact, minimizes conductor cold flow, holds down joint temperatures.

Other features of these Hot Line Clamps include jaws of identical metals so that thermal expansion is always equal. Large ears or lugs provide a positive grip with all makes of hot sticks. And then there's the unique spring.

The rugged Vanadium steel is the heart of the clamp. It makes up for variables caused by fault currents, load and atmospheric changes; compensates for the "relax" and "flow" tendencies of conductors under stress; offsets the different torque linemen use in tightening connections.

For top dependability and long-run economy specify Fargo Spring Loaded Hot Line Clamps. Your distributor can furnish them in four sizes which cover the range in wire sizes from #8 to 750MCM.

Ask your Line Material Field Engineer for complete details.

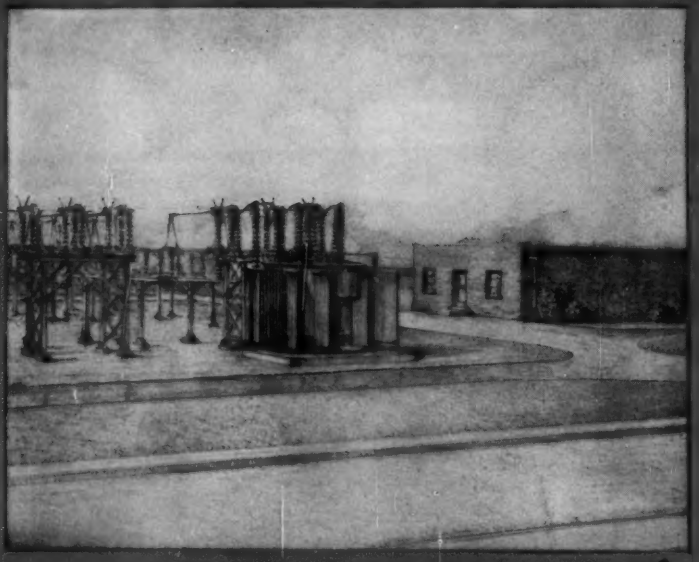
Manufactured by
FARGO MFG. COMPANY, INC.
Poughkeepsie
New York

FARGO

Distributed by
LINE MATERIAL COMPANY
(A McGraw Electric Company Division)
Milwaukee, Wisconsin
In Canada, CANADIAN LINE MATERIALS, LTD., Toronto, Canada

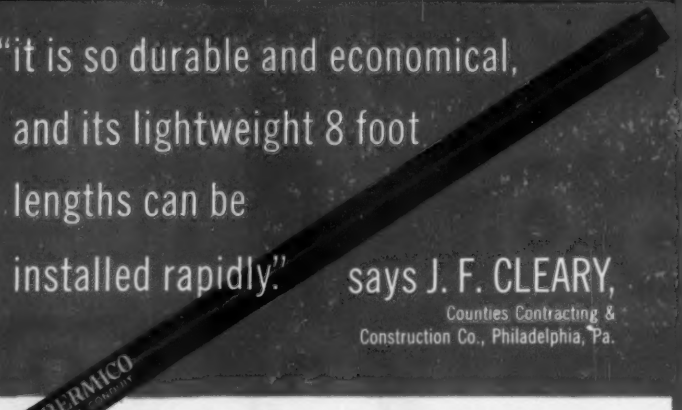
LM

BERMICO® electrical conduit to carry 13,000 volt cables because . . .



"it is so durable and economical, and its lightweight 8 foot lengths can be installed rapidly."

says J. F. CLEARY,
Counties Contracting & Construction Co., Philadelphia, Pa.



A total of 25 miles of Bermico Conduit will soon be running beneath the streets of Baltimore, between Baltimore Gas & Electric's Center and Woodbrook Substations. Of fifteen lines connecting the points, three will be used at once, the others as power needs grow.

Precisely engineered Bermico Conduit is made of wood cellulose impregnated with pitch. It resists alkalies and acids, stays tight and strong. It is completely uniform. Low in cost, it installs quickly and easily.

No wonder so many leading electrical contractors specify Bermico, for every type of soil from coast to coast.

Immediate shipment of all sizes and fittings is guaranteed.

Distributed by WESTINGHOUSE Electric Supply Company
Offices in principal cities

BROWN COMPANY
Berlin, New Hampshire
GENERAL SALES OFFICE: 150 CAUSEWAY STREET, BOSTON 14, MASS.
SOLKA PULPS • SOLKA-FLOC • NIBROC PAPERS • NIBROC TOWELS • NIBROC KOWTOWLS
NIBROC TOILET TISSUE • BERMICO SEWER PIPE AND CONDUIT • ONCO INSOLES • CHEMICALS

One-Line Dealers?

Appliance retailer of future may be like today's auto dealer, NARDA members told

National Appliance and Radio-TV Dealers Association convention in Chicago last month brought forth some ideas pertinent to utility sales planning. Items:

• Dealers were urged to brush aside multiple franchises and concentrate on selling products of one or two broad-line manufacturers. According to General Electric Co's C. W. Theleen, this would give them stronger brand identification, allow controlled inventory and better turn over, plus more advertising assistance.

• Westinghouse Electric Corp likewise is looking for this "automobile-type" appliance dealer to emerge in future retail distribution. John W. Craig, Westinghouse vice president, said this new type dealer should have a physical plant capable of displaying all the products of this line, have the ability to handle trade-ins and make a profit, and be alert to growing potentialities of built-in and package kitchens.

• A "national trade-in week" to promote appliance obsolescence was proposed by Gene Rankin, vice president, National Trade-in Guide Co. Dealers, he said, could offer special trade-in values on washers, ranges, refrigerators and other appliances during the event.

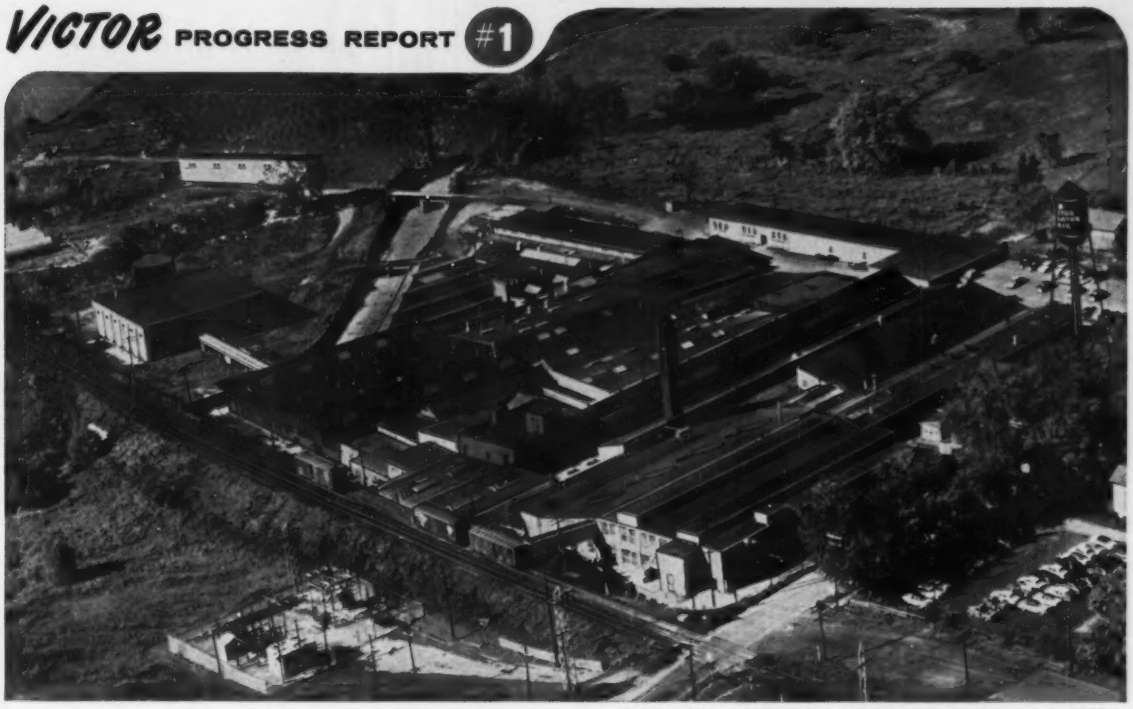
• J. R. Waters, chairman of Edison Electric Institute's Dealer Coordination Committee urged dealer support for this year's utility promotional activities: (1) EEI's coordinated campaigns, (2) Operation Home Improvement, (3) "Live Better . . . Electrically" program, (4) National Television Week, (5) EEI's "Housepower" promotion, (6) National Electrical Week.

Lighting Betters Sales

Effective store lighting can boost a retailers' sales by 20%, while the cost of such a program can be limited to but one-half of 1% of his gross revenue. This was revealed by statistics presented at a Store Lighting Clinic sponsored by Illuminating Engineering Society's New York Section.

(*More S&S on page* 162)

VICTOR PROGRESS REPORT #1



Portion of Victor plant outlined in red has been added since 1948.

VICTOR expands plant area 20%

TO MEET INCREASED INSULATOR DEMAND

"BETTER INSULATORS THROUGH RESEARCH"

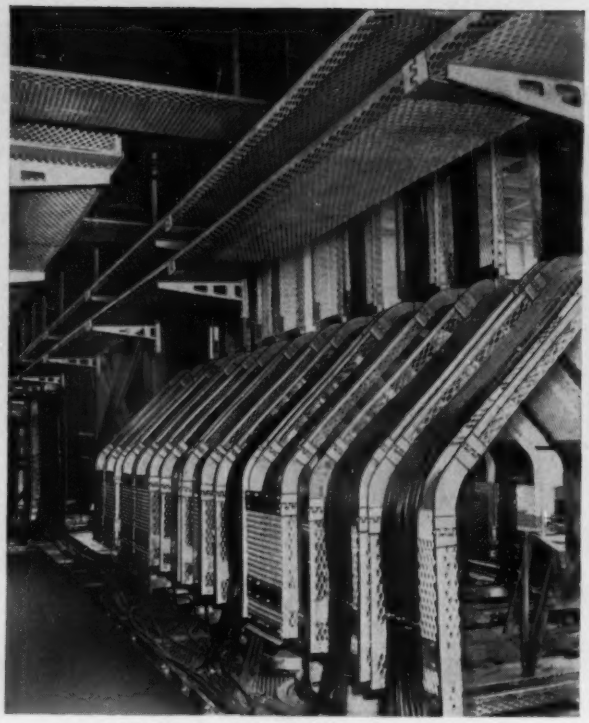
Sixty-three years ago the manufacture of wet process porcelain insulators began at VICTOR. Since then, the plant facilities at VICTOR have had to expand continually to meet increased demand. In fact, during the last seven years alone, VICTOR has had to enlarge its plant area 20% to provide greater facilities for switch and bus insulator, bushing and special porcelain manufacture, raw material storage, for new ceramic and electrical laboratories and in-plant loading docks. VICTOR'S modern plant, engineering and research facilities are unsurpassed in the industry! You just can't buy better insulators!

SPECIFY VICTOR

Purified Porcelain Insulators!

VICTOR INSULATORS DIVISION
I-T-E CIRCUIT BREAKER CO.
VICTOR, N. Y.

Low and High Voltage Pintypes • Suspensions • Guy Strains
Spools • Switch and Bus Insulators • Custom Designed Porcelain
Insulator Hardware



Cope Cable Trough installed at Ohio Edison Company, Niles Station. Hatzel & Buehler, Electrical Contractors.

Many Miles of Cable Supported by COPE TROUGH

Ohio Edison engineers adopted Cope Cable Trough and Rakit supports for many miles of cable in the Niles Station. Utility engineers everywhere are turning to Cable Trough to save costs. The modern Cope design featuring the exclusive pin-type coupling save even more on installation costs.

The Cope 70,000 Series is more flexible than ever before since the new pin-type coupling eliminates the need for many standard fittings, is more readily installed than any other type trough, and fits easily into awkward spaces. Riser elbow for elevation changes.

Armor interlock and other semi-rigid cables are supported by Cope cable ladders. These, too, are readily installed with the pin-type coupler. Simple clamps secure cable to cross members.

Our engineers are ready to work with you. Write us today for full details on new 70,000 Series.

T. J. COPE, INC.

711 SOUTH FIFTIETH STREET, PHILADELPHIA 43, PENNA.

Cope

GROUND TENTS

ROD GRAPPLES

CABLE REEL JACKS

WARNING SIGNS

CROSS ARM SHEAVES

Sales High in TVA

Survey shows most major appliances have an exceptionally high saturation. Only TV lags

Consumers of Tennessee Valley Authority power purchased about $1.5 billion worth of household electrical appliances since the end of World War II, says TVA in announcing results of a survey it made jointly with 151 of its power distributors.

And saturation figures for the heavy-use appliances, as to be expected, are well above what is true nationally. According to James E. Watson, TVA's director of power utilization, this is what the survey showed about the 1,218,000 homes and farms served with TVA power:

Appliance purchases by TVA power consumers since 1945 were considerably greater than the average consumer purchases throughout the nation. In Tennessee the residential consumers spent an average of $1,600 for electrical appliances in the 9-year period from 1946 through 1954. This compares with about $1,350 spent by the average U. S. consumer in the same period.

Percentage of homes using an electric range in the TVA area is nearly 2½ times the average for the nation—758,000 homes or 62% of the total; compared with a national saturation of 27%.

3 Times the Water Heaters

Proportion of consumers using electric water heaters in the TVA area is almost three times the national average. A total of 508,000, or 42%, of the homes receiving TVA power have water heaters. Electric water heaters are used by only 15% of the homes in the nation.

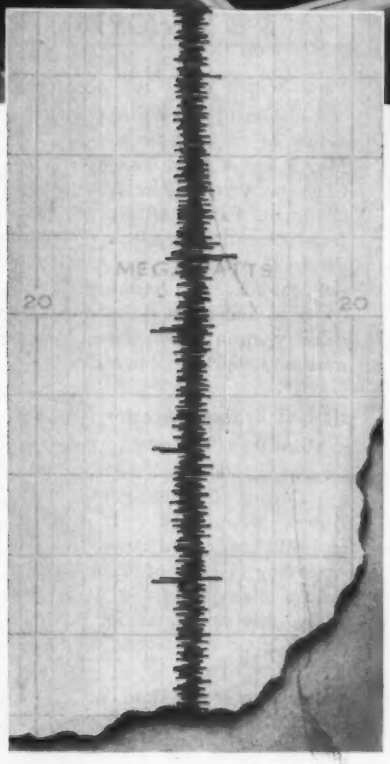
Even in the use of as popular appliance as the refrigerator the TVA area is ahead of the pack; they are used in 1,150,000, or 95%, of homes. Nationally, 92% of wired homes have them.

Use of the other major appliances, including the electric food freezer and washing machine, is about the same in the TVA area as the average for the nation.

Television set ownership is down among TVA homes—626,000 in 51% of the homes compared with a national average of 75%. Reason:

(*Continued on page* 164)

Two men of the L&N engineering team which makes load allocation a cost-cutting science . . . shown in the Central Illinois Public Service Dispatcher's Office at Pana, Ill.



Actual size section of chart record

They make red ink pay!

To the trained operating engineer, those red curves spell fuel savings. They're charted by the ever-present Speedomax Telemeters and Recorders – integral components of the Leeds & Northrup Area Control installations across the country.

Area Control makes sense to operating men because it's the only load control with the flexibility that lets your Dispatcher allocate generation as required: either on a strictly incremental basis, or in any other manner to meet his area's regulating requirements. Then too, he can at all times schedule interchange precisely with neighboring utilities.

And, the beauty of today's Area Control is that it combines advanced, field-tested equipment (new, faster telemetering; new Area Control allocation circuits; Early-Bird type computers) with application engineering based on *hundreds* of control installations . . . in daily operation. It's the combination offered only by L&N . . . the organization that can make your operating "red ink" pay dividends.

LEEDS NORTHRUP

300 LOAD-FREQUENCY CONTROL INSTALLATIONS 1927-56

MALLEABLE
Integral Spur
GUY HOOKS

Exclusive
CONICAL SPUR

Does away with the need for a lag screw!

Linemen like them — they're easier to mount, require one less piece to juggle.

Troubleshooters like them — they eliminate TV and radio interference caused by loose contact between lag screw and guy hook.

Maintenance men like them — they require less replacements.

Storekeepers like them — there's one less piece to order, to stock and to handle.

Purchasing agents like them — they cost less than a separate guy hook and a lag screw.

Field tested and proved the most economical and serviceable guy hook available — and they're **malleable iron** to outlive, outwear, outlast plain carbon steel hardware, castings, stampings or forgings.

	Max. Bolt Dia.	Max. Strand Dia.	Thimble Dia.
Model P135AX	5/8"	7/16"	1 7/16"
Model P133AX	3/4"	1/2"	1 9/16"
Model P132X	7/8"	3/4"	2 3/8"

SAMPLES AVAILABLE UPON REQUEST

MALLEABLE IRON FITTINGS COMPANY

Pole Hardware Division Branford, Connecticut
N.Y. Office: 30 Church St.
Canadian Mfr. & Dist.: LINE & CABLE ACCESSORIES, Ltd. TORONTO

MIF

Representatives: William J. Cottrell Co., Portland, Ore. • James H. Drew Corp., Indianapolis, Ind. • Industrial Engr. & Equip. Corp., Los Angeles, Cal. • JSG Electric Co., Chicago, Ill., Lee-Smith Co., Miami, Fla. • B. H. McCoin, Knoxville, Tenn. • William J. O'Brien, Memphis, Tenn. • Robert P. Smith & Co., Jacksonville, Fla., E. A. Thornwell, Inc., Atlanta, Ga. • J. P. Voight, Summerville, S. C. • Waltham, DeWitt & Krusi, San Francisco, Cal. • L. G. Wendegatz, Kansas City, Mo. • Williamson Sales Co., Shreveport and New Orleans, La.; Dallas, Houston, Tex.; Pine Bluff, Ark. • O. C. Witte Co., Detroit, Mich.

TVA Sales High

(*Continued from page* 162)

Many parts of the TVA area are not within the range of TV broadcast facilities. In those parts that have satisfactory TV reception the average number of sets is about as great as elsewhere in the nation.

An example of the manner in which the people of the region are seeking ever greater comfort and convenience in home living is shown by the use of appliances for heating in winter and cooling in summer. About 145,000, or 12%, of the TVA power consumers heat their homes exclusively with electricity. Another 11% use electricity in combination with other fuels. Thirty-three percent of the TVA area homes are cooled by attic or window fans and 8% have some air conditioning; 9,000 are fully air conditioned.

S & S SHORTS

Farm Wiring Meet Set

A National Farm Wiring Conference —first of its kind—is scheduled for May 3 and 4 at the LaSalle Hotel in Chicago. According to H. H. Watson, chairman, Farm and Rural Market Development Committee, National Electrical Manufacutrers Association, the conference will bring together top technical and promotional men from industry, farm organizations, government and educational agencies.

Half of Requests Are for Heating

More than half of all applications for new or additional service received by Cowlitz County Public Utility District No. 1 last year were for residential electrical space heating. According to Lacy M. Peoples, commercial manager of the Washington utility, they accounted for 1,276 of a total 2,178 applications received.

Water Heater for Hard Water

A new electric water heater for use in areas where high corrosive water conditions exist has been announced by Hotpoint Co. To be priced about $30 below last year's models, the unit contains a Perma-stone cement lining said to be rust and corrode-proof. Available in either 50 or 80-gal sizes, the new water heater will be ready for shipment this month.

(*More S & S on page* 200)

Save time and money by using

G&W

unit package

Splicing Kits

ENGINEERED FOR BETTER CABLE JOINTS

G & W SPLICING KITS include each necessary item of material in the correct grade and proper quantity for making a cable joint of our standard design (or your own design or special type).

For your convenience, we carry in stock all the materials required to make joints on any size cable and we regularly supply these materials in unit package form.

When You Order Cable Splicing Materials in Unit Package Kits You *Save Time and Money* Because—

- Time and expense of securing various items from different sources are saved.
- No lengthy material specifications are necessary.
- Both design and installation methods can be standardized.
- All joints are properly designed to industry standards by expert engineers.
- Each item is supplied in the correct quantity for a properly designed joint.
- Accumulation of dead stock is avoided. No waste.
- All materials are kept clean and ready for use.
- Each Unit Splicing Kit is labeled for easy identification.
- Easy to quickly estimate costs for any particular job.

Send for your copy of publications (new, January, 1956)

BULLETIN JA56—(Supersedes bulletins CJ1, CJ2, CJ3, CJ4, CJ5, CJ6R) List prices—2 way & 3 way Splicing Kits.

BULLETIN JB56—(Supersedes CJ7) List prices Terminating Kits.

BULLETIN JC56—(Supersedes CJT) Telephone Cable Splicing Kits.

G&W ELECTRIC SPECIALTY CO.

7780 Dante Avenue, Chicago 19, Illinois, U.S.A.

Representatives in principal cities of U.S.A.
Also Made In Canada by Powerlite Devices, Ltd., Toronto, Montreal & Vancouver

J561

Trench-Digging Machine

This trench-digging machine can be operated by one man for ditching and backfill operations. The machine, known as the Go-For-Digger, can be set up for digging trenches from 6 to 16 in. wide and as much as 5 ft deep. Manufacturer claims the machine will dig 400 to 500 ft per hr at 3-ft depths in materials such as loam or clay. Ditches can be dug close to walls and banks.

Dirt is drawn into the machine's hopper by action of the cutters and holders and is then forced onto a hydraulic conveyor. The dirt is deposited on either side of the machine at the will of the operator.

A. J. Parsons, 80 W. Maiden St, Washington, Pa.

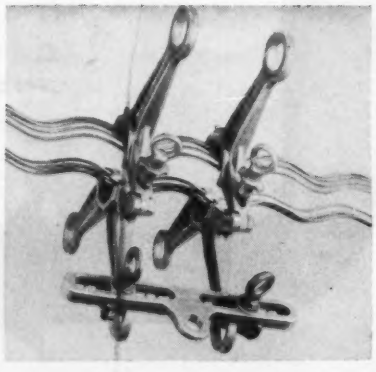
Ground-Rod-Driving Unit

A ground-rod driver is attached to the front end of a machine known as a Pneumatractor. It is a 125-cfm gasoline-engine-driven air compressor on a chassis with a heavy industrial transmission and rear axle. The Pneumatractor is completely self-contained and self-propelled.

The unit has sand tires, front-end loader frame, and 15-ft air shell with 80-lb paving breaker. The Pneumatractor, equipped with the front-end ground-rod-driving attachment, is under field test by a northeastern utility.

Schramm, Inc, West Chester, Pa.

Armor Rod Wrench Holder



The armor rod wrench holder is reported to enable a single man to lift simply and safely a set of loaded armor rod wrenches to the conductor. Loaded wrenches are locked at the desired interval in the holder, and a clamp stick is hooked into the lifting eye. Holder and wrenches can then be balanced as a rigid unit, and the wrenches are properly aligned for quick mounting.

The armor rod wrench holder can be used for application of straight or preformed armor rods. It is made of heat-treated aluminum alloy with bronze eye-screws and steel washers.

A. B. Chance Co, Centralia, Mo.

(*More New Equipment on page* 168)

WHY WIRE AND CABLE JACKETED WITH NEOPRENE GIVE EXTRA-LONG SERVICE

NEOPRENE RESISTS WEATHERING — resists deterioration from exposure to sunlight, weather, and temperature extremes through long years of service.

NEOPRENE RESISTS OIL AND GREASE—and exposure to chemicals and solvents has little effect.

NEOPRENE IS RESILIENT—has excellent resistance to flex cracking, abrasion, chipping, cutting.

NEOPRENE PROTECTS AGAINST ELECTROLYTIC ATTACK—neoprene coverings protect lead sheaths from electrolytic action.

NEOPRENE WON'T SUPPORT COMBUSTION — provides maximum safety in danger areas where flame propagation is a serious hazard.

NEOPRENE RESISTS OZONE and **CORONA CUTTING** — neoprene resists both causes of deterioration equally well.

Neoprene's remarkable *balance of properties* is the big reason why it's the best jacketing material for wire and cable. Rugged neoprene jacketing gives maximum protection in conduits, above ground—even buried direct in earth. Neoprene has had over 20 years of successful field experience in all kinds of rubber products. You can count on long-term dependability when you specify wire and cable jacketed with neoprene. For full details get in touch with your wire and cable supplier.

NEOPRENE
The rubber made by Du Pont since 1932

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

MAIL THIS COUPON TODAY!

E. I. du Pont de Nemours & Co. (Inc.)
Elastomers Division, EW-2
Wilmington 98, Delaware

FREE! THE NEOPRENE NOTEBOOK. Every issue contains interesting stories about products made with neoprene. Actual case histories give you the facts about neoprene's longer service life. Clip coupon to get on the mailing list.

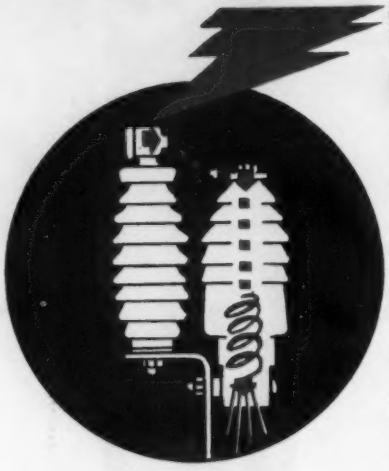
*Name*_____ *Position*_____

*Firm*_____

*Address*_____

*City*_____ *State*_____

NO LOCK-OUT RADIO-NOISE LEAKAGE TROUBLE



WITH

R T & E's NEW LIGHTNING ARRESTER

(EXPULSION TYPE)

R T & E ELIMINATES ARRESTER TROUBLE ONCE AND FOR ALL . . .

BECAUSE RT & E's ARRESTER is completely out of the circuit except during lightning discharge LOCK-OUTS ARE IMPOSSIBLE

BECAUSE R T & E's ARRESTER elements are kept near ground potential levels—RADIO NOISE IS ELIMINATED

BECAUSE R T & E's ARRESTER elements are completely isolated from the line LEAKAGE CANNOT BE PRESENT

Plus

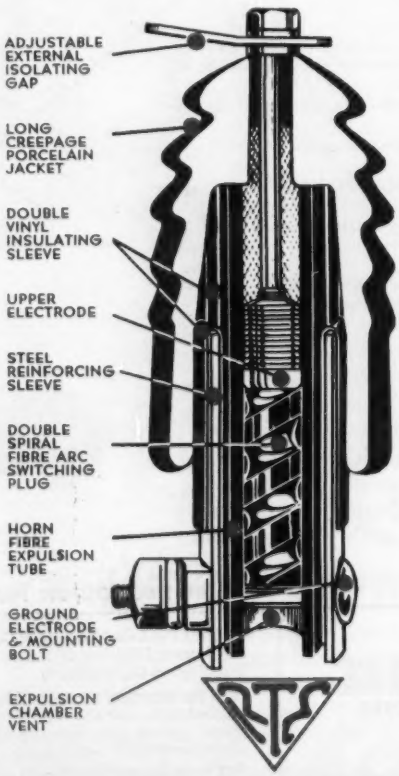
HIGH SURGE STRENGTH

COMPLETELY WEATHERPROOF

LONG SERVICE LIFE

5 YEAR GUARANTEE

Get Trouble-free service plus Maximum Lightning Protection When You Choose R T & E Lightning Arresters



Send for complete details on design and construction today. Ask for Arrester Bulletin 6000

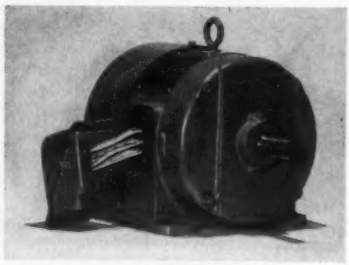
R T & E Co.

WAUKESHA WISCONSIN

Two AC Motor Lines

Two lines of enclosed, non-ventilated, fan-cooled, ac motors are designated as "standard enclosed" and "severe duty enclosed." They will replace a single line of 1-5 hp motors.

The "standard enclosed" motor features a steel conduit box and fan cover. The conduit box has "keyhole" mounting (see illustration), and mounting screws need not be removed. A ½-in. conduit hole with a ¾-in. knockout is provided for versatility. The conduit box is completely gasketed with cork neoprene. The steel fan cover is said to be light, rugged and easy to realign on reassembly. Cast iron is retained on the rest of the enclosure.



The "severe duty" line is basically the same as the standard line, except that it is suitable for use in corrosive or excessively moist atmospheres. All threaded parts are coated with a special lubrication to prevent threads from seizing. Neoprene-sealed washers on the through bolts and a new type shaft seal give additional moisture protection, while corrosion resistance is furnished by the cast-iron conduit box and fan cover.

Both new lines feature long permanumbered leads for use with wire nuts. Every enclosed, foot-mounted motor is now equipped with a lifting eye.

General Electric Co, Schenectady 5, N. Y.

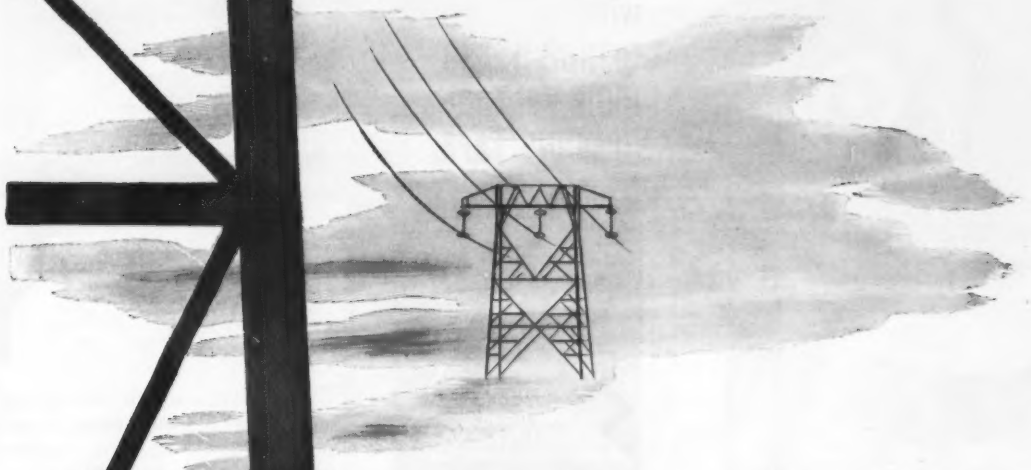
Underground Cable Rack

A corrosion-resistant, aluminum-alloy, lock-type rack has been added to a line of underground cable racks. The rack provides nine holes for a choice of hook location to allow for variations of cable spacings. The hook is also an aluminum development.

(*Continued on page* 170)

How Ebasco helps
the electric power industry

KEEP SALES AT HIGH LEVELS



ARE YOU now realizing the greatest sales potential from your market area?

ARE YOU developing the demand for additional electric service through proven promotion methods?

ARE YOU using sales techniques that help keep the load evenly distributed throughout the year?

ARE YOU employing a program that will maintain favorable public opinion?

The answers to these questions are vital to the future growth and prosperity of your company. And Ebasco, with long experience in all phases of utility operation, is able to supply them. Ebasco specialists will study markets and trends, will offer tested advertising and promotion ideas, will help with your sales organization structure, public relations program and sales training.

Backed by nearly 50 years of association with utilities of all sizes, Ebasco can provide a skilled, objective viewpoint to supplement the activities of your own personnel.

To find out what Ebasco sales and public relations service can do for your company to keep sales at high levels write for our booklet—"The Inside Story of Outside Help". Address Ebasco Services Incorporated, Dept. M., Two Rector Street, New York 6, N. Y.

Ebasco Teamwork gets things done anywhere in the world

NEW YORK
CHICAGO
DALLAS
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EBASCO — ENGINEERS · CONSTRUCTORS · BUSINESS CONSULTANTS

Appraisal • Budget • Business Studies
Consulting Engineering • Design & Construction • Financial • Industrial Relations • Inspection & Expediting
Insurance, Pensions & Safety • Purchasing • Rates & Pricing • Research
Sales & Public Relations • Space Planning • Systems & Methods • Tax • Traffic
Washington Office

Long Island Lighting Company Makes

PERMANENT

Moisture-Proof

SPLICES

with

BISHOP No. 30 HIGH VOLTAGE SPLICING TAPE

Long Island's vast network of parkways carries one of the greatest concentrations of vehicular traffic in the world. Safe driving on these busy roads relies heavily on safe lighting. The Long Island Lighting Company uses Bishop No. 30 High Voltage Tape as one of the approved tapes for important splicing jobs like the underground 5 Kv parkway series lighting cable splice shown in the photographs.

No. 30's exceptional resistance to the erosive action of corona and ozone, plus its excellent aging qualities, insures a lasting splice. It fuses into a homogeneous, moisture-proof wall which equals or betters the original insulation. No. 30 is used as the primary insulating tape for splicing high voltage cables operating up to 15 Kv and having conductor temperature ratings of 85°C. It far exceeds A.S.T.M. specifications.

Complete technical data on No. 30 and other Bishop tapes for cable splicing is yours for the asking. Write us today!

A Long Island Lighting Co. splicer starts taping 5 Kv joint with No. 30 High Voltage Splicing Tape.

He wraps continuously with firm tension, half-lapping the tape to insure moisture-proof fusion of tape layers.

The No. 30 primary insulating tape is built up to approximately 1½ times the original cable insulation. After taping is completed a lead sleeve is wiped on both ends.

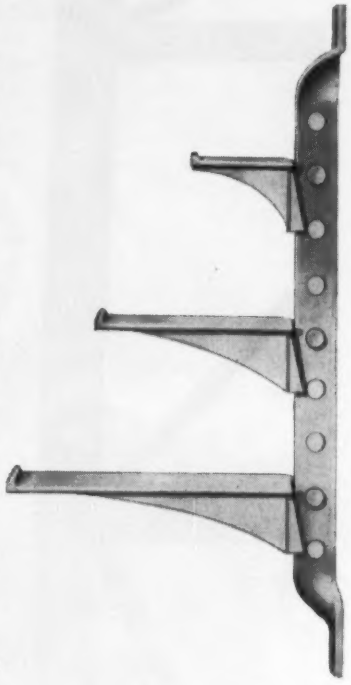
MORE THAN A CENTURY OF ELECTRICAL INSULATION

BISHOP MANUFACTURING CORPORATION

6 CANFIELD ROAD
CEDAR GROVE (ESSEX CO.) N. J.

Underground Cable Rack

(*Continued from page* 168)



The lock-type style is said to assure snug rigid fit, eliminating wobbly movement in any direction. Insulators are locked on the hook by a stop at the outer end.

The rack is 28¾ in. long with mounting bolt hole spacing set at 27 in. The hook is 2 in. wide and extends 8½ in. from the rack face.

Hubbard & Co, 6301 Butler St, Pittsburgh, Pa.

Green-Yellow Slide Rule

A light-alloy, green-yellow slide rule is claimed to eliminate eyestrain, blurring, and errors in reading calibrations. Non-rusting metal construction is said to resist warping, swelling and binding.

Green-yellow shade coincides with the optimum sight point of the spectrum, the manufacturer claims, and thereby eliminates violet and red rays which focus in front of and behind the retina.

The new slide rule is made in 6 and 10-in. trig, log-log standard rules or made to special order.

Pickett & Eckel, Inc, 1109 S. Fremont Ave, Alhambra, Calif.

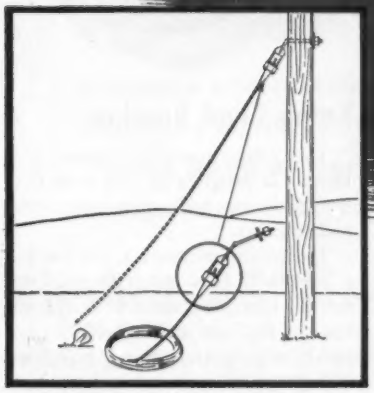
(*More New Equipment on page* 172)

Complete a down-guy IN 5 MINUTES?

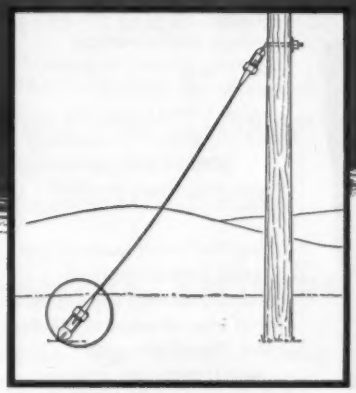
We'll bet your man can do it with . . . STRANDVISE®

Don't take that bet until you've had some of your men try this sure, simple, easy way to install down-guys — we'll even bet that you'll be boasting that some of them can do it in less than five minutes.

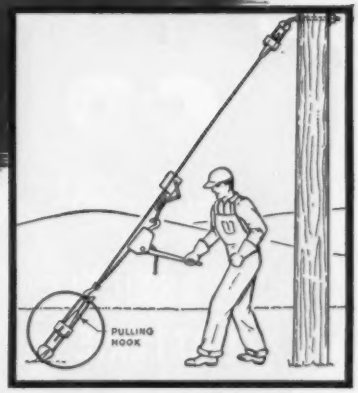
FOLLOW THESE THREE EASY STEPS:
HOIST AND COME-ALONG NEED NEVER BE IN THE WAY



STEP 1 Assemble STRANDVISE to pole-top hardware and complete pole-top installation. Do not cut strand from coil; it is usually wasteful.



STEP 2 Assemble STRANDVISE to anchor eye. Measure strand hand-tight to lower end of STRANDVISE, then cut. Insert strand and feed through STRANDVISE, just hand-tight.



STEP 3 Now place come-along and hoist and apply tension. It's just as easy for double or triple guys as it is for singles.

NOW STEP BACK, THE JOB IS DONE . . . IT'S JUST THAT SIMPLE

And here's a new pulling hook that makes the job even easier, although a pulling hook isn't needed if anchor rod will take a come-along.

Have some of your men try the Reliable STRANDVISE for easy five minute down-guy installations . . . we'll gladly supply samples for the test.

STRANDVISE — available for 3/8" through 7/16" strand, all grades. Stainless steel (rigid) and galvanized steel (flexible) bails for all types of guy attachments.

Reliable POWER LINE CONNECTORS AND CONSTRUCTION SPECIALTIES

ELECTRIC COMPANY 3145 CARROLL AVENUE CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

Now—"engineered" power

for switchgear-control —emergency lighting —auxiliary power

C&D PLASTICAL® and PLASTICELL® BATTERIES

Compact, modern-design "power plants" engineered for specific applications! C & D PlastiCals and PlastiCells give you completely dependable power—*where power must not fail!*

PlastiCal—with lead-calcium grids for maximum life—is conservatively engineered for at least 25 years in full-float service. PlastiCell—with high-tensile alloy grids—has a projected life of 14 years in float service.

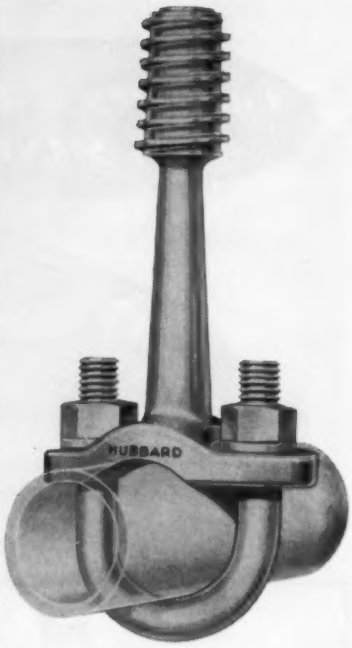
WITH BOTH PLASTICAL AND PLASTICELL YOU GET SUCH ADVANCED C & D DESIGN EXTRAS AS:

1. Extra-long life—exclusive design combines advantages of both suspended and supported plate construction.
2. Triple insulation—thick Fiberglas mat, microporous separators, and perforated Koroseal retainer.
3. Saftee-Vent—outstanding C & D development that prevents accidental battery explosions.
4. Crystal-clear plastic jars—heat-resistant and hermetically sealed.
5. Plastite Post Seals—for easier maintenance, and at the lowest lifetime cost.

Write for C & D Specification Bulletins:
CP-536 Rev. 1 on PlastiCal Batteries
CP-537 Rev. 1 on PlastiCell Batteries

C&D BATTERIES, INC.
of Conshohocken, Pa.
Industrial Batteries since 1906

SALES AND SERVICE OFFICES IN PRINCIPAL CITIES FROM COAST TO COAST



Lamp Lead Bracket

This aluminum-alloy lamp lead bracket is designed for use with 1¼-in. pipe on externally wired mast arms and brackets.

The corrosion-resistant bracket has a standard 1-in. pin-style insulator thread. Clamping surface is 1¾ in. wide at the base and is held in position by a ½-in. aluminum U-bolt fitted with hexagonal nuts and lock washers.

The bracket extends 6⅛ in. from the center of pipe to the top. It weighs 8¾ oz.

Hubbard & Co, 6301 Butler St, Pittsburgh, Pa.

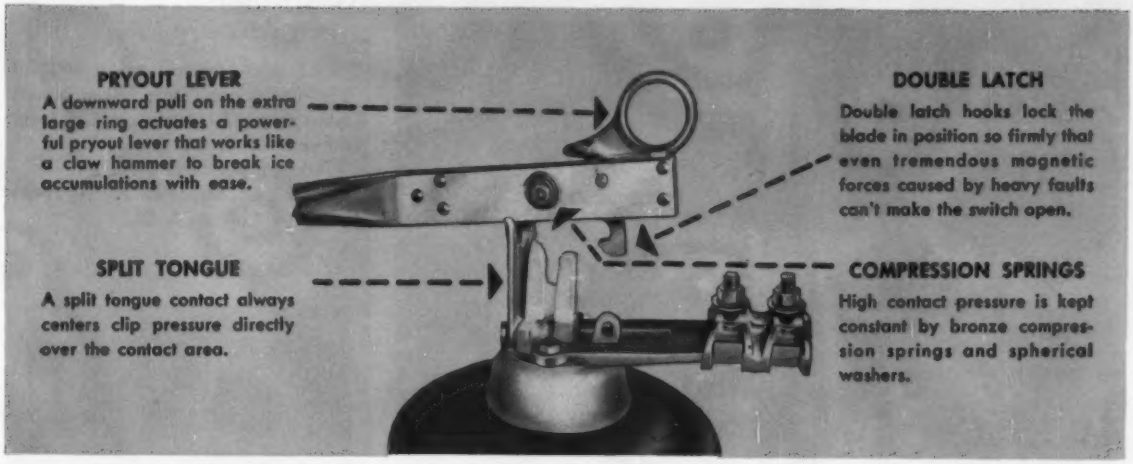
Gearmotors

A line of Gearmotors and Motogears is designed to meet NEMA ratings. Features of the line include: Accessible operating parts; cast iron housings; oil-tight design; integral, positive-locking backstop; and output speeds from 6 to 280 rpm.

Double reduction (Type DF) Gearmotors have ratios from 6.2:1 through 31.4:1 and transmit up to 30 hp. Triple reduction (Type TF) units have ratios from 38.4:1 through 292:1 and transmit up to 20 hp.

Double reduction (Type DB) Motogears have ratios from 6.2:1 through

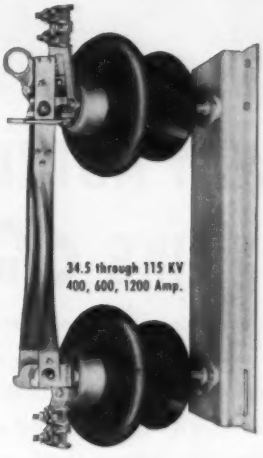
(*Continued on page* 174)


PRYOUT LEVER
A downward pull on the extra large ring actuates a powerful pryout lever that works like a claw hammer to break ice accumulations with ease.
DOUBLE LATCH
Double latch hooks lock the blade in position so firmly that even tremendous magnetic forces caused by heavy faults can't make the switch open.
SPLIT TONGUE
A split tongue contact always centers clip pressure directly over the contact area.
COMPRESSION SPRINGS
High contact pressure is kept constant by bronze compression springs and spherical washers.

These Hook Stick Switches last longer

because they can take more punishment...

Linemen can always close Chance BT Switches easily...from any angle...contact blades have extreme rigidity and are designed to withstand heavy side thrusts.



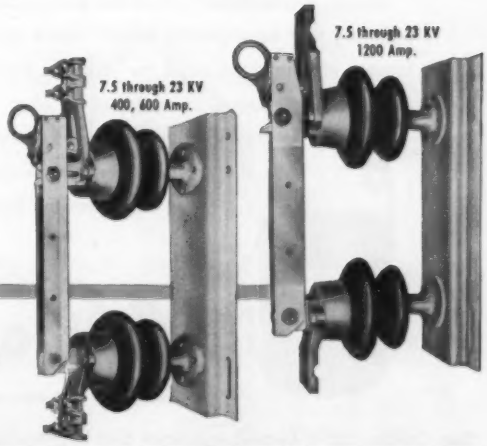
Chance BT Disconnect Switches

Talk about tough, rugged disconnect switches... you should see *Chance BT Hook Stick Switches* in operation.

You'll find unequalled strength in the double-trussed tubular blade on models rated from 34.5 through 115 KV... the heavy flat parallel bus bars that serve as blades on the 23 KV and smaller 1200 ampere switches... and the flanged reinforced bus bar blades on the 400 and 600 ampere switches.

In all models of this sturdy switch, which can take anything the "slambangingest" lineman can dish out, contact blades are held rigidly in place—making quick sure contacts possible at all times.

Chance BT Switches can really take it... giving you years of extra service... try 'em, you'll see. If you'd like to have more information first, why not see your Chance representative or write for catalog material and test data?



ABC INDUSTRIES

A·B·CHANCE CO.

CENTRALIA, MISSOURI • San Francisco, California

(In Canada: A. B. Chance Company of Canada, Ltd., Toronto 13)

CB56-12

WHY NOTHING PROTECTS LIKE Subox PAINT

Subox paints save money now . . . and through the years to come. They are the only paints in America made with *chemically-active suboxide of lead* — one of the most effective anti-corrosive agents known. It is a heavy colloidal pigment that spreads smoothly, evenly, thoroughly; adheres closely and endures for many years.

Subox* and Subalox* paints are economical to apply, and are so enduring that they greatly reduce future maintenance costs. They largely eliminate the need for scraping and repriming each time repainting is required.

Many of America's foremost industries rely on Subox paints.

If you require corrosion protection in your business, write for the brochure "Subox Paints."

Subox Inc.

Established 1924 3 Fairmount Plant Hackensack, N. J.

See Catalogues in Sweet's Industrial and Engineering Files

*Trade Mark

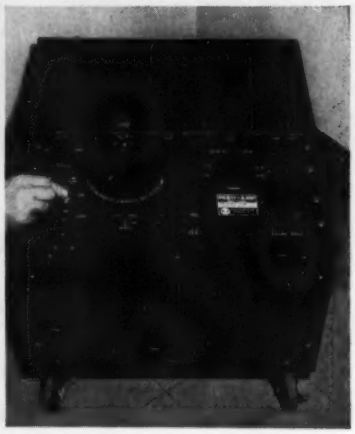
Gearmotors

(*Continued from page* 172)

38.4:1 and transmit up to 60 hp. Triple reduction (Type TB) units have ratios from 47.1:1 through 292:1 and transmit up to 20 hp.

Ask for Book No. 2447.

Link-Belt Co, Dept PR, 307 N. Michigan Ave, Chicago 1, Ill.



Test Instrument

Model IDR 35 provides a continuously adjustable voltage or high current source for testing and calibration of protective relays, current transformers, and related devices.

The new test instrument consists of an autotransformer which has a voltage winding with output taps. A low-voltage adjustable dc output is supplied to test relay target and seal-in units or similar dc devices.

Tests on practically all current-actuated protective relays may be made with more than 10 times rated current, the manufacturer reports. Mounted on heavy casters, the 80-lb unit is 17 in. high, 20 in. wide, and 12½ in. deep.

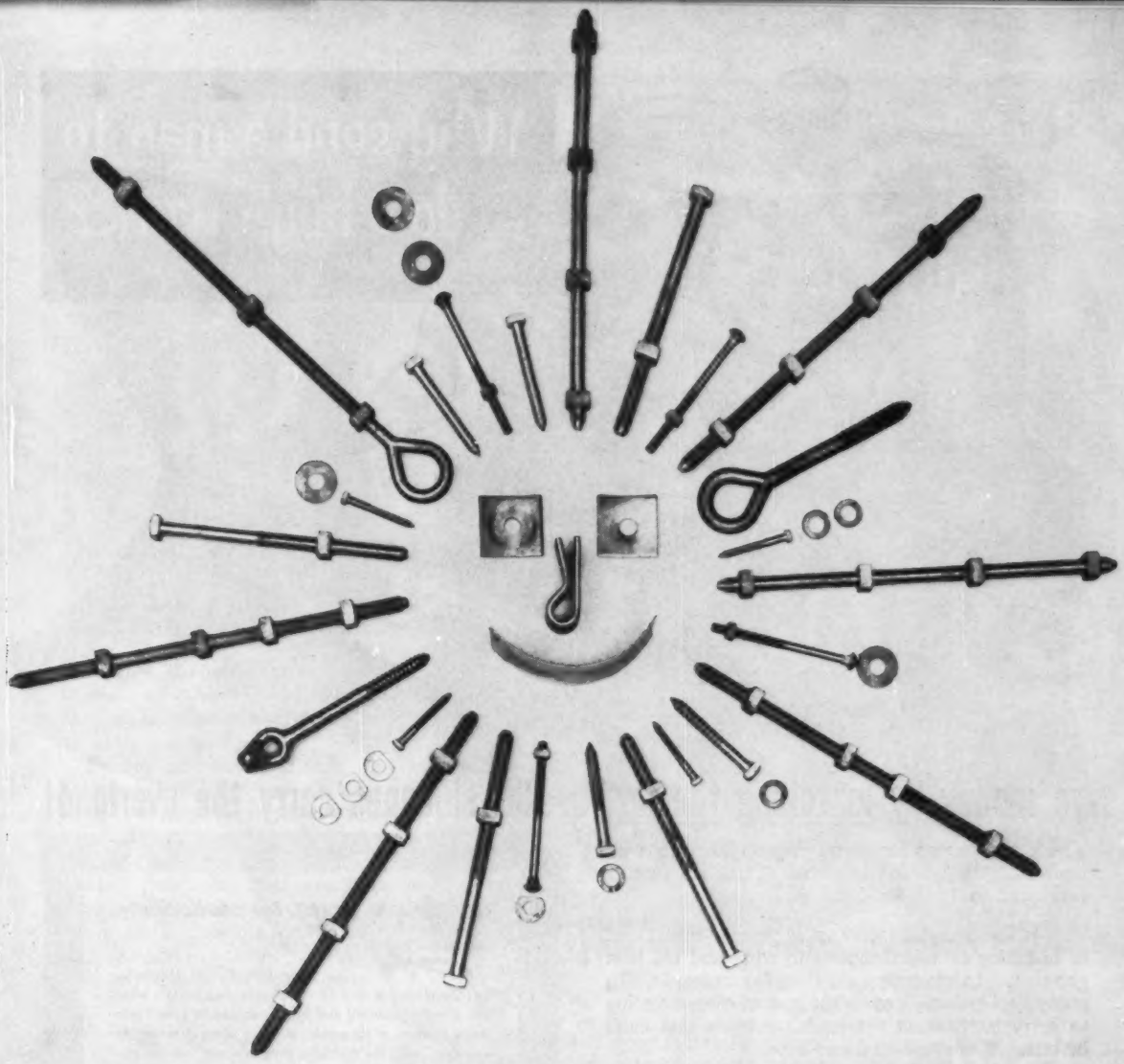
Multi-Amp Corp, 10 Third St, Newark 7, N. J.

Load-Tap-Changing Unit

A redesigned load-tap-changing mechanism reportedly provides reduced maintenance, quieter operation, and longer contact life in a line of medium transformers and small, three-phase voltage regulators.

Manufacturer states: Laboratory

(*Continued on page* 177)



Mainstay

These commonplace items . . . bolts and nuts, screws and washers . . . are the backbone of Hubbard's more than 4,000 items of pole line hardware. Back of each is more than a century's manufacturing experience. In each is the strength and durability, the uniformly high quality that has made Hubbard the leader of pole line hardware for industry.

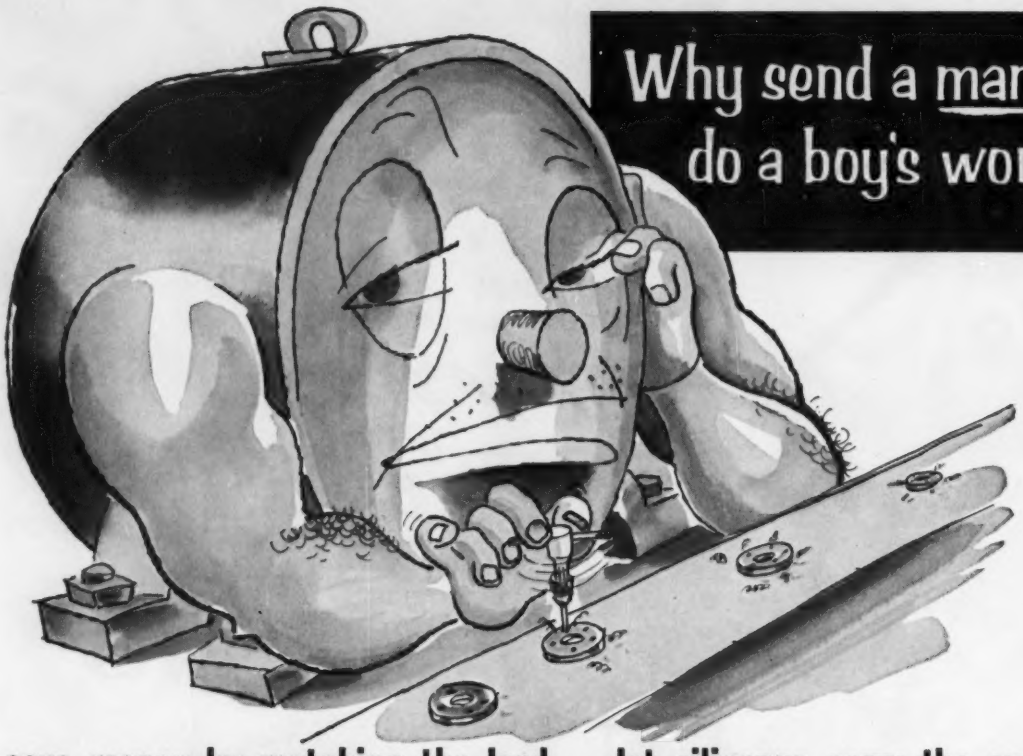
Hubbard Pole Line Hardware is stocked by more than three hundred wholesalers . . . men whose business it is to know and service local needs. A call to your Hubbard distributor will bring his helpful assistance to your line construction needs.

QUALITY! FOR MORE THAN A CENTURY

Secondary Racks • Wireholders • Pole Seats and Balconies • Braces • Drive Hooks
Wood Strain Insulators • Clevises • Extension Arms • Long Span Hardware • Pins
Clamps • Guards • Stubbing Bands • Guy Protectors • Guy Clamps • Pole Struts
Clips • Straps • Hangers • Carriage Bolts • Lighting Standards • Lighting Brackets
Eye Bolts • Pole, Corner and House Brackets • Guy Hooks • Strain Plates • Lags
Machine, Carriage and Hubeye Bolts • Sidewalk Guys • Autogap Lightning Arresters

HUBBARD AND COMPANY

Pittsburgh 1, Pa.
Chicago 50, Ill.
Oakland 8, Calif.



Why send a man to do a boy's work?

save money by matching the load . . . let silicones carry the overload!

You get a service factor ranging up to 50% with Dow Corning Silicone insulated (Class H) motors compared to 15% for Class A.

This built-in service factor saves you the initial cost of installing oversized motors to withstand the heat generated in reversing service, for example. In many applications, it saves the cost of over-motoring to carry intermittent overloads, or loads that can't be matched in standard frame sizes.

And eliminating the need for over-motoring gives you a better power factor and higher efficiency, because the smaller silicone insulated motors come closer to operating at full load most of the time.

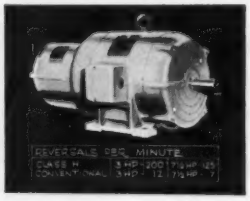
You also get more reliable service because motors insulated with Dow Corning silicones have superior resistance to heat, to a combination of heat and moisture, and to corrosive atmospheres.

Remember over-motoring is outmoded

to help you speed up production

LOUIS ALLIS

The Louis Allis Co. of Milwaukee has developed a line of rapid reversing motors which are silicone insulated and blower cooled to give a maximum number of reversals. A 3 hp Class H motor, for example, will do 200 idle reversals per minute compared to 12 for a conventional motor of the same frame size. A 7½ hp silicone insulated motor will do 125 idle reverals per minute compared to 7 for a conventional motor. These motors offer new production economies in any operation where high reversal capacity is required.



Dow Corning Corporation, Dept. 4402, Midland, Mich.

Please send me sources of supply for new Silicone (Class H) ☐ Motors ☐ Transformers

☐ Information on Louis Allis motors for rapid reversing service

NAME _____ TITLE _____

COMPANY _____

STREET _____

CITY _____ ZONE _____ STATE _____

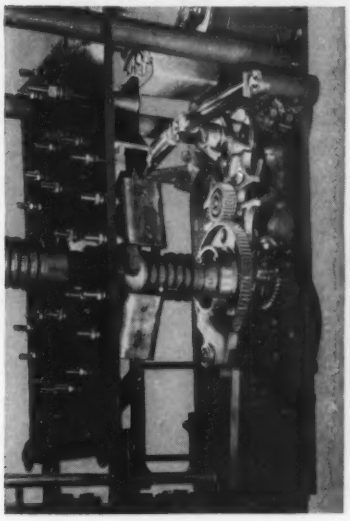
DOW CORNING SILICONES

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

ATLANTA • CHICAGO • CLEVELAND • DALLAS • DETROIT
LOS ANGELES • NEW YORK • WASHINGTON, D. C. (Silver Spring, Md.)
CANADA: Dow Corning Silicones Ltd., Toronto
GREAT BRITAIN: Midland Silicones Ltd., London
FRANCE: St. Gobain, Paris

Load-Lap Changing Unit

(*Continued from page* 174)



tests show the peak operating noise of the new mechanism is 20 db quieter than the old type; it requires only half as much maintenance.

Factors contributing to this performance are: Redesigned Geneva gear; two hydraulic dashpots; and oil immersion of whole mechanism in one compartment.

The tap changing compartment has a hinged door on front for easy access and a nitrile rubber gasket for better seal against oil leakage.

General Electric Co, Schenectady 5, N. Y.

Germanium Rectifier

A 30-kw liquid-cooled germanium power rectifier is applicable for all types of dc load requirements, except those requiring heavy surge currents or those subject to heavy intermittent overloads or occasional short circuits.

Output currents of 540 to 750 amp can be obtained for input voltages of 26 to 66 v rms maximum. Volume of the rectifier is 190 cu in.

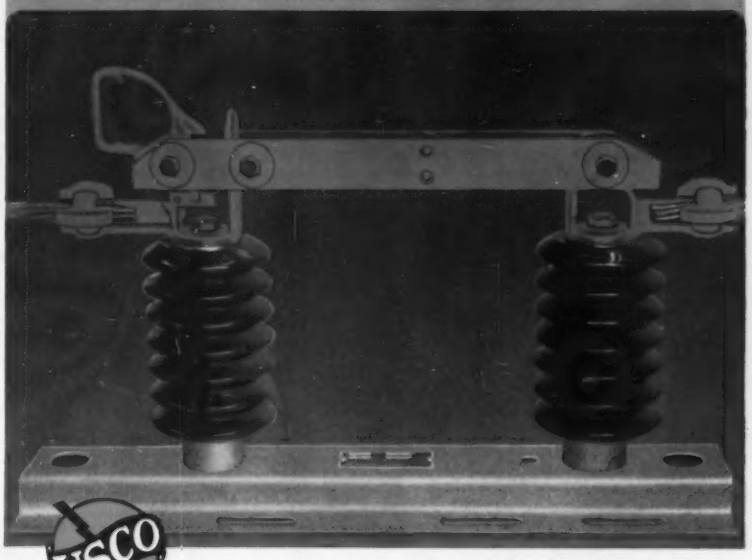
Manufacturer says that unlimited operation life can be expected from −55 to 75C maximum when equipment is designed to operate within specified voltage, current and temperature rise ratings.

International Rectifier Corp, El Segundo, Calif.

(*Continued on page* 178)

USCO TYPE HDH SWITCH

is a dependable, inexpensive disconnect switch for sectionalizing!



Available 5-15KV, 200 and 400 Ampere Ratings.
Shown is 15KV, 400 Ampere.

The USCO type HDH Disconnect is designed especially for dependable, inexpensive sectionalizing. Applied on your distribution system, this light-duty disconnect will by-pass, disconnect, or isolate with all the dependability of a big, costly switch.

The type HDH is a single-pole, single-throw, hookstick-operated switch for mounting vertically or underhung on wood cross arms.

It affords such big-switch features as • high-pressure contact • large operating ring with cam-out leverage • blade guide to assure positive blade alignment • blade latch to eliminate opening except by deliberate action • trussed blade with spacing between bars • galvanized steel wing-channel (illustrated) or regular channel base • hot-dip-tin terminal pads • open-positive blade stop at 90 degrees or otherwise as specified.

All component parts of this and other USCO switches are designed and manufactured in the USCO factory.

For full details, write directly to:

USCO Power Equipment Corp.

829 North 36th Way, Birmingham 4, Alabama—Phone 59-7241

Designers and Manufacturers of High Voltage Electrical Equipment for Utilities, Cooperatives and Industry.

Why Pay 3 MEN to Watch Your Line Crew Work?

START SAVING TIME and MONEY with

TEL-E-LECT 2-MAN UTILITY RIGS

If you're using 5-man crews and old fashioned utility equipment (even on '55 chassis) you've got *three extra men on most jobs!*

With Tel-E-Lect equipped trucks you'll discover the great time and money saving advantages of 2-man construction trucks. Leading public utility companies throughout the country are now using 2-man trucks to do a large share of the work once performed by 5-man crews—and they're realizing increased profits in the process.

Your 2-man crew won't work any harder, but they'll produce more and do it faster than many 5-man crews. You see, Tel-E-Lect builds the services of three men into its utility truck equipment. Tel-E-Lect equipment provides new power features that require only two men to perform the tasks once done by five!

The 2-man construction equipment described here lets you put smaller crews on everyday jobs while freeing big crews and big equipment for the really tough highline jobs.

THE TEL-E-LECT COMBINATION BODY

This *complete* package consists of a rugged steel body, stowaway derrick, winch and drive, pole hole digger and drive and rapid forward-reverse transmission. Three simple installation steps by your local mechanic puts the Combination Body on your truck chassis regardless of make or model. You simply install power take-off . . . mount body and connect power drive . . . and install cab controls. It's now ready to go to work!

A Tel-E-Lect all steel Combination Body is completely equipped with Stowaway derrick, digger and power units—a model 2-man construction truck.

Front mounted Tel-E-Lect "T" frame derrick and Tel-E-Lect Pole Hole Digger gives this utility truck 2-man versatility.

WINCH, DIGGER AND DRIVE KITS FOR ALL POPULAR-MAKE TRUCKS

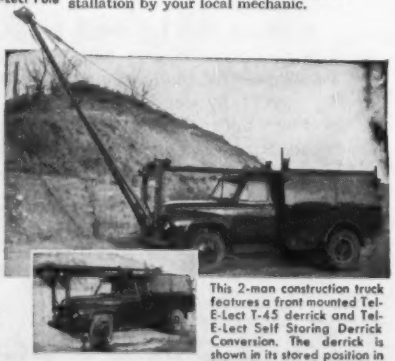
A series of easily installed Tel-E-Lect kits make it possible to install derricks, diggers and power drives at the front of your present utility truck. The flexibility and economy of 2-man operation can be extended to any size or model of International 4x4, Ford, Chevrolet, GMC, Dodge or other truck.

These Tel-E-Lect kits are designed specifically for the particular truck on which they will be installed. Each kit contains every part needed for easy installation by your local mechanic.

TEL-E-LECT SELF-STORING DERRICK CONVERSION KITS

An entirely new concept of derrick storage eliminates the hazards once involved in derrick erection and take-down. Your front mounted "A" or "T" frame derrick stores on top of the truck—doesn't use valuable body space for storage.

Your truck's winch supplies power to raise or lower derrick. With a double drum winch you'll get "live-boom" flexibility and with a single drum winch you'll get easily adjustable derrick elevation! This low cost unit fits any truck with or without body and is quickly installed.



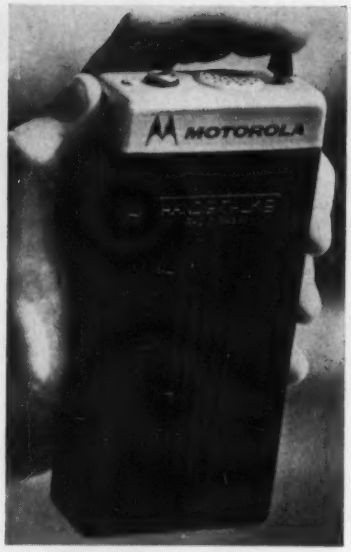
This 2-man construction truck features a front mounted Tel-E-Lect T-45 derrick and Tel-E-Lect Self Storing Derrick Conversion. The derrick is shown in its stored position in the smaller photo.

Tel-E-Lect provides other kits for individual requirements. Write us about any of your utility truck problems.

TELE-LECT PRODUCTS, INC.

TEL-E-LECT PRODUCTS, INC.

10,003 Minnetonka Blvd., Minneapolis 26, Minnesota



Pocket Radio Pager

This pocket radio receiver can single out a particular person anywhere in a plant. The unit, which slips in the pocket or clips on the belt, sounds an alerting buzz and then delivers a voice message to only the single person being paged.

The 10-oz radio pager utilizes transistors, mercury cell battery, built-in Ferrite rod antenna, and other miniaturized components.

For exceptionally high noise level areas there is provision for using a hearing-aid type earpiece or a lapel-type speaker as options.

Motorola Communications & Electronics, Inc, 4501 Augusta Blvd, Chicago 51, Ill.

MORE NEW PRODUCTS

General Electric Co, Schenectady 5, N. Y., has a **22-channel, automatic oscillograph** (PM-21) with accommodation for 1 to 22 bifilar-type and 4 zero-trace galvanometers.

Arrow-Hart & Hegeman Electric Co, Hartford, Conn., offers a 3-wire, 2-wire combination **duplex grounding receptacle** which provides for two separate circuits with common ground.

Hotpoint Co, 5600 W. Taylor St, Chicago 44, Ill., offers a corrosion-proof automatic **electric water heater** in 50 or 80-gal capacities.

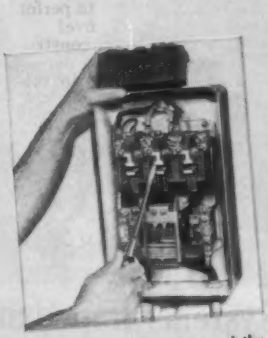
Here's Why We Specify
SQUARE D Starters
on the Machinery We Buy

PERFORMANCE, EASY INSPECTION AND MAINTENANCE

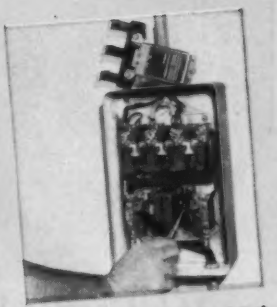
Sure, we like Square D performance because it keeps our "down time" at a minimum. BUT—everybody knows that even the best starter needs periodic inspection and preventive maintenance. We like the way Square D makes it easy to handle those routine jobs.

OFF-THE-SHELF PARTS KITS

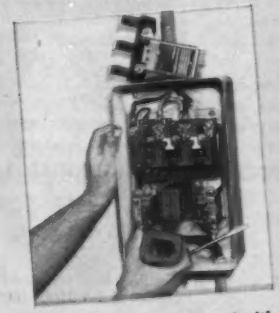
They make normal maintenance and modifications easier than ever. Packaged parts include interlocks, contacts, coils, overload relays, pushbuttons and selector switches. They're easy to buy, easy to identify, and faster to install.



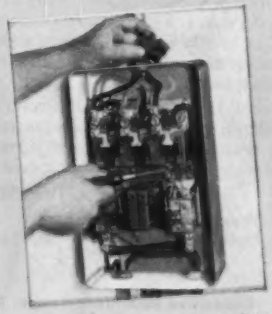
1 Loosen two screws and the arc chamber cover comes off. Every contact surface can be inspected at a glance.



2 Remove four screws and entire movable assembly can be lifted off. Disconnect two wires and slip off magnet coil.



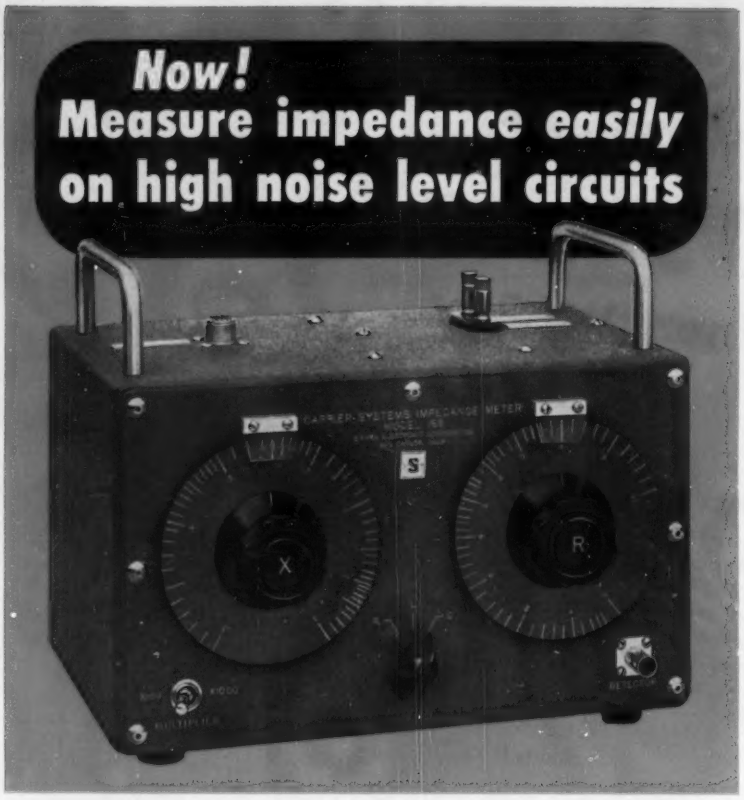
3 Contacts are attached with separate screws—they can be removed and replaced without disturbing any wiring. A screwdriver is the only tool needed.



4 Sizes 0 through 4 starters have these separate mounting electrical interlocks for easier installation. Contact block is attached from front of panel with two screws.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY



Sierra 166 Carrier Systems Impedance Meter

New Sierra Model 166 is specifically designed for measurements on high noise level power and telephone lines and circuits where conventional instruments are ineffective. Covering all frequencies from 30 kc to 300 kc, it can be used with signal sources ranging in output from ⅛ to 1600 voltamperes.

Model 166 is ideal for determining impedance vs. frequency characteristics, and its wide impedance range permits use (through series coupling capacitors) on "hot" lines. On low noise level laboratory circuits, the instrument measures impedance using a standard vacuum tube voltmeter as a detector. Under less ideal conditions, impedance may be measured conveniently by using a frequency selective voltmeter (such as Sierra Models 101B, 104 or 108) as the detector.

Brief specifications of new Model 166 are given here. Please write for complete data on Impedance Meter and Sierra Carrier Frequency Selective Voltmeters.

TENTATIVE SPECIFICATIONS — MODEL 166

Frequency Range:	30 kc to 300 kc
Inductive Reactance Range, X_L:	30 to 3000 ohms at 100 kc
At a given frequency, f_{kc}:	$X_L = \frac{(\text{X dial reading})\ f_{kc}}{100}$
Capacitive Reactance Range, X_C:	30 to 3000 ohms at 100 kc
At a given frequency, f_{kc}:	$X_C = \frac{100\ (\text{X dial reading})}{f_{kc}}$
Resistance Range, R:	0 to 1000 ohms
Accuracy:	±5% on impedance magnitude and phase angle
Maximum Signal Input:	1600 voltamperes, not exceeding 400 volts, or 4 amperes, whichever is larger.
Dimensions:	11⅛ inches wide, 8⅞ inches high and 8¼ inches deep, over all
Weight:	Approximately 8 lbs.

Specifications subject to change without notice.

Sierra Electronic Corporation
San Carlos 2, California, U.S.A.
Sales representative in major cities

Manufacturers of Carrier Frequency Voltmeters, Wave Analyzers, Line Fault Analyzers, Directional Couplers, Wideband RF Transformers, Custom Radio Transmitters, VHF-UHF Detectors, Variable Impedance Calibrated RF Loads, Reflection Coefficient Meters, Bi-Directional Power Monitors, Television Waveform Monitors, Color Television Picture Monitors, Impedance Meters.

sierra

CATALOGS—BULLETINS

● **MOTORS:** Performance and application features of a line of drip-proof, enclosed, and explosion-proof motors from ½ to 40 hp are given in 12-page Bulletin No. 1700. Louis Allis Co, Milwaukee, Wis.

● **GERMANIUM RECTIFIERS:** Voltage regulation, controls, cooling, electrical protection, and other features of germanium rectifiers are covered in 4-page Bulletin No. GR-100. Hanson-Van Winkle-Munning Co, Church St, Matawan, N. J.

● **STEEL FRAMING:** Specifications and applications of a line of steel framing are given in 8-page brochure. The line includes channels, nuts, clamps, rollers, brackets, and other fittings. American Steel & Iron Works, 58th and Lowe Ave, Chicago 21, Ill.

● **CONTROLLER PARTS:** Catalog No. 55 (95 pages) lists controller renewal parts for electric apparatus and motor controls. Products of 17 manufacturers are listed. Brownell Distributors, Inc, 306 Canal St, New York, 13, N. Y.

● **FILTERS:** Vertical filter line is pictured and described in Bulletin No. 111. The 8-page folder details air wash, sluicing, and shaking devices. Industrial Filter & Pump Mfg Co, 5916 Ogden Ave, Chicago 50, Ill.

● **BATTERY CHARGER:** Bulletin No. 13-200 describes a diverter-pole, motor-generator battery charger for servicing of control-bus batteries in main stations and substations. Recent improvements in mechanical design are covered in the 4-page folder. Electric Products Co, 1725 Clarkstone Road, Cleveland 12, Ohio.

● **DEFLECTION INDICATOR:** Magnetic-amplifier type deflection indicator is described in 8-page Bulletin 05B8385. Booklet includes schematic and circuit diagrams, operating procedure, mounting dimensions, and description of the indicator which is designed to safeguard hydrostations, compressor and pumping stations, etc. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

● **SYNTHETIC FLUIDS:** Properties, applications and characteristics of a line of synthetic fluids and lubricants are covered in Form 6500D. The 52-page booklet gives full descriptions of these polyalkylene-glycol derivatives. Carbide & Carbon Chemicals Co, 30 E. 42nd St, New York 17, N. Y.

● **ALUMINUM PRODUCTS:** Descriptions, applications and specifications for a line of aluminum mill products are contained in a 24-page booklet. Kaiser Aluminum & Chemical Corp, 1924 Broadway, Oakland 12, Calif.

● **INDUSTRIAL FANS:** Bulletin No. 5306 describes Series 106 fans for industrial air and material handling requirements. The 72-page booklet contains full ratings for the line. American Blower Corp, Detroit 32, Mich.

● **INSULATION PROTECTION:** An 8-page bulletin describes a cold-applied asphaltic composition that provides a durable protective coating on all types of thermal insulation. Photographs of typical installations and accompanying data are included. American Bitumuls & Asphalt Co, 200 Bush St, San Francisco, Calif.

(*More Catalogs on page* 182)

Who's handling public relations for you behind the Iron Curtain?

It's not an easy assignment—or the kind you'll find many people volunteering for.

But there *is* an important "public relations" job to be done behind the Iron Curtain—for you . . . for America . . . for the whole concept of freedom, free enterprise and individual rights. This job is an opportunity and a challenge as well as a serious responsibility for American business. Fortunately, with your help, there *is* an agency that can do the job—*Crusade for Freedom,* which supports Radio Free Europe and Free Europe Press.

Both these powerful, privately operated organizations continually challenge the barrage of Communist misstatements and false truths. Using saturation radio broadcasts and mass newspaper drops from message balloons, Radio Free Europe and Free Europe Press are constantly on the offensive against the Red campaign to annihilate right, reason and national pride.

Continued and heated Communist protests testify to the tremendous effectiveness of Radio Free Europe and Free Europe Press. Support freely given by free American business and private citizens will increase this effectiveness and the scope of their operations. A contribution now is perhaps the best investment you can make towards a peaceful, prosperous world.

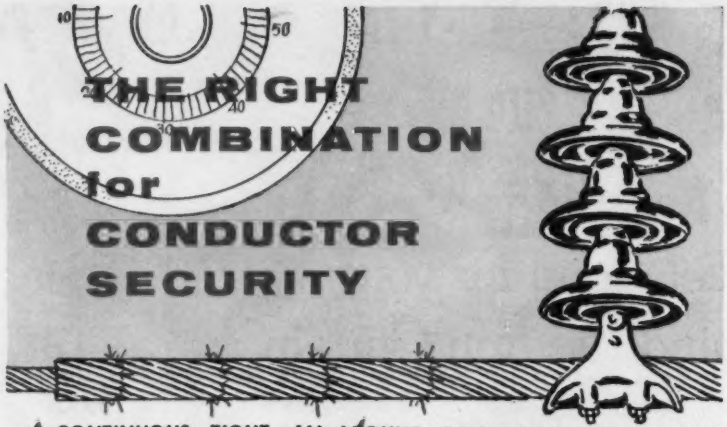
Give generously. It's your future!

Check list for business executives in the Crusade for Freedom

- ☐ Order display material for your company bulletin board.
- ☐ Plan a paycheck stuffer to fully acquaint your employees with the importance of the Crusade for Freedom.
- ☐ Plan to conduct an in-company solicitation.
- ☐ Match employee funds with *your Truth Dollars.*

PUBLIC SERVICE ADVERTISING COUNCIL

For campaign material and information write **CRUSADE FOR FREEDOM,** 345 East 46th St., N. Y. C. 17.



CONTINUOUS, TIGHT, ALL-AROUND GRIP FROM END TO END

the overhead conductor

fine FANNER superformed ARMOR RODS

UNIFORM FULL-LENGTH GRIP

Fanner Superformed armor rods contact conductor permanently and tightly *at every point* — not just at clamps.

COMPLETELY EFFECTIVE ARMORING

Exclusive, precision formed construction provides rugged, lasting protection for conductor.

DEPENDABLE PERFORMANCE

Every installation fits perfectly into place. Fanner precision design eliminates special skill on part of lineman.

RE-USABILITY

When reconductoring or line relocation demands it, Fanner Superformed Rods may be reapplied without rod waste or loss of armoring.

LOW INSTALLED COST

Fine Fanner Superformed Rods provide both initial and long term economy through low cost, easy application and multiple capabilities.

Licensed for use under Patent No. 2,275,019

THE FANNER MANUFACTURING CO.

Brookside Park • Established 1894 • Cleveland 9, Ohio

AGENTS IN PRINCIPAL CITIES

ARMOR RODS • TAP ARMOR • LINEGUARDS • PATCH RODS

Catalogs-Bulletins

(*Continued from page* 180)

• **FEEDER BUSWAY:** Construction and application of a low-impedance feeder busway system for general-purpose power distribution applications are discussed in 16-page Bulletin No. GEA-6151. It lists ratings, weights, dimensions, installation data, and guide form specifications for the busway (Type LVD) which is available in 600 to 4,000-amp ratings. General Electric Co, Plainville, Conn.

• **DISTRIBUTION TRANSFORMERS:** Line of standard station-type, liquid-filled distribution transformers from 150 to 500 kva is covered in 16-page Bulletin No. 136. Featured is a series of charts showing performance data, dimensions and weights for single and 3-phase transformers, both oil or askarel-filled. R. E. Uptegraff Mfg Co, Scottdale, Pa.

• **MEASURING ELEMENTS:** Line of permanent-magnet, moving-coil, recording dc ammeters, voltmeters and millivolt-voltmeters is pictured and described in 8-page Catalog No. 40-55. Esterline-Angus Co, Inc, P. O. Box 596, Indianapolis 6, Ind.

• **ROTARY SWITCHES:** Rotary control and instrument switches are subject of 8-page Bulletin No. 14B8112. Operation of switches is discussed and installations on vertical and bench-type control boards are illustrated. Table of ratings, outline of dimensions, and photos are included. Allis-Chalmers Mfg Co, 932 S. 70th St, Milwaukee, Wis.

• **FRACTIONAL HP MOTORS:** Line of fractional horsepower dc motors and equipment for direct application and built-in use is covered in 12-page Bulletin No. GEA-6068. Included are typical applications, product features, ratings and specifications for standard models. General Electric Co, Schenectady 5, N. Y.

• **SERVICE ENTRANCE:** Bulletin P-1255 describes service entrance mast kits devised for servicing low-roof, ranch-type houses. Hubbard & Co, 6301 Butler St, Pittsburgh 1, Pa.

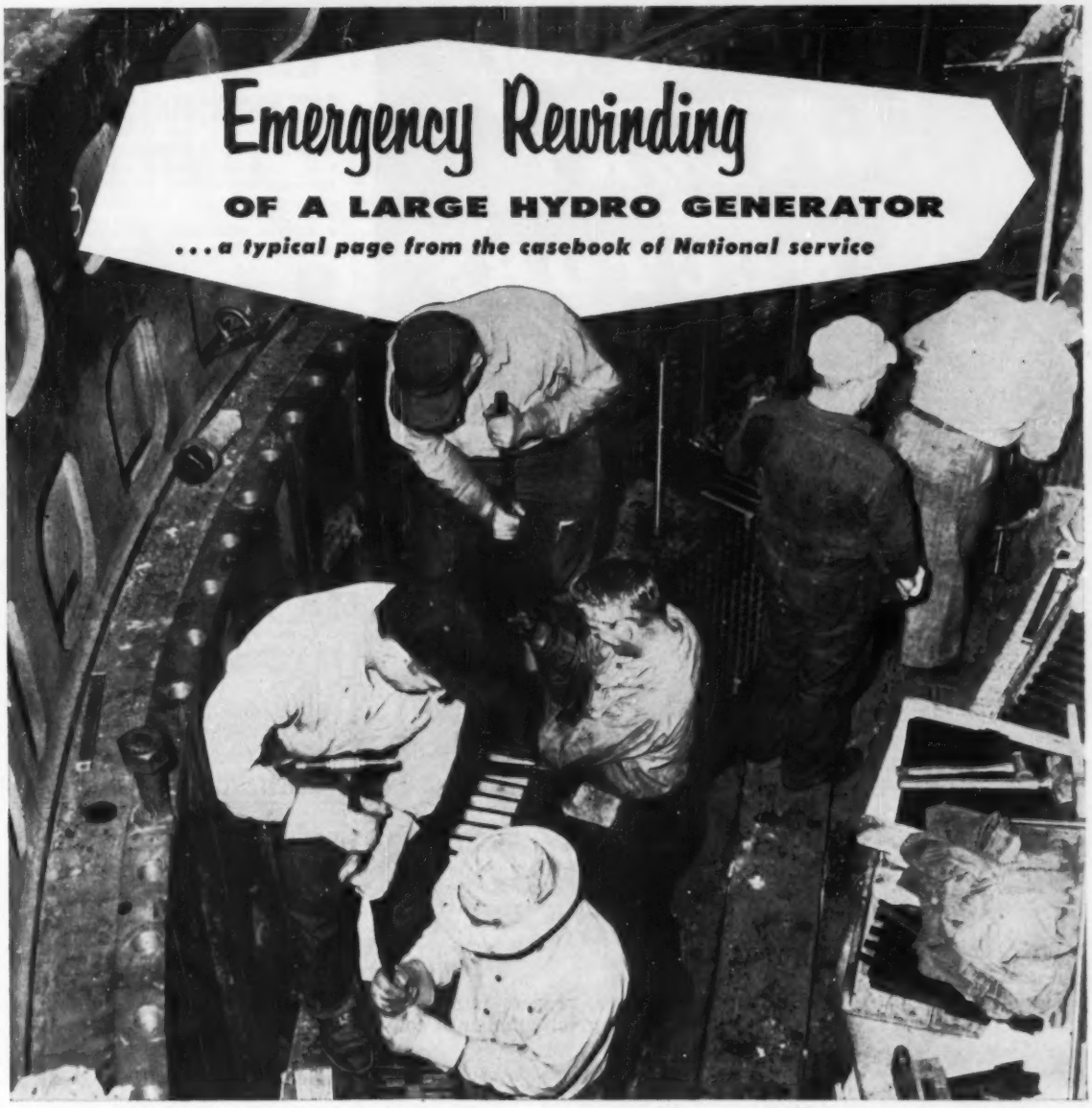
• **CRANE ELECTRIFICATION:** A system of electrification for cranes is covered in Catalog No. 2021-A. The 8-page booklet describes the line of aluminum (Inverted-Y) conductors with under-running sliding-shoe current collectors for applications requiring 300 to 1,000 amp. Cleveland Crane & Engineering Co, Wickliffe, Ohio.

• **COAL DUST CONTROL:** Bulletin No. 551-D describes the control of dust from coal-handling operations. The 4-page brochure covers the use of local exhaust ventilation and cloth-tube-type dust collectors. Wheelabrator Corp, Mishawaka, Ind.

• **SEALERS:** Properties and applications of a line of adhesives, coatings and sealers are listed in 12-page catalog. Minnesota Mining & Mfg Co, 411 Piquette Ave, Detroit 2, Mich.

• **MAGNETIC STARTERS:** Line of reversing and non-reversing line voltage ac magnetic starters is subject of 8-page Bulletin No. 1020. Construction, application and engineering specifications are included. Essex Wire Corp, 1601 Wall St, Fort Wayne, Ind.

(*More Catalogs on page* 184)



When this 65,000 KVA waterwheel generator "blew up," National people worked around the clock until it was back in service. National field engineers supervised stripping of the machine, re-stacking of the iron and installation of the coils. By the time the core was ready, coils were flowing out of National's Columbus plant in twice-weekly partial shipments. More than 10,000 pounds of mica tape and 50,000 pounds of copper—fabricated by National's insulation department and wire mill—were used. The last of the 420 coils was completed six weeks after the job was started. Total down time on the generator was only nine weeks. And the rewound machine had a capacity of 74,750 KVA.

Unusual case? No, just a typical example of what National can do. That's why you should invite your nearby National field engineer to tell you all about National services—why you should think first of National when you have a problem with any large rotating electrical machine.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

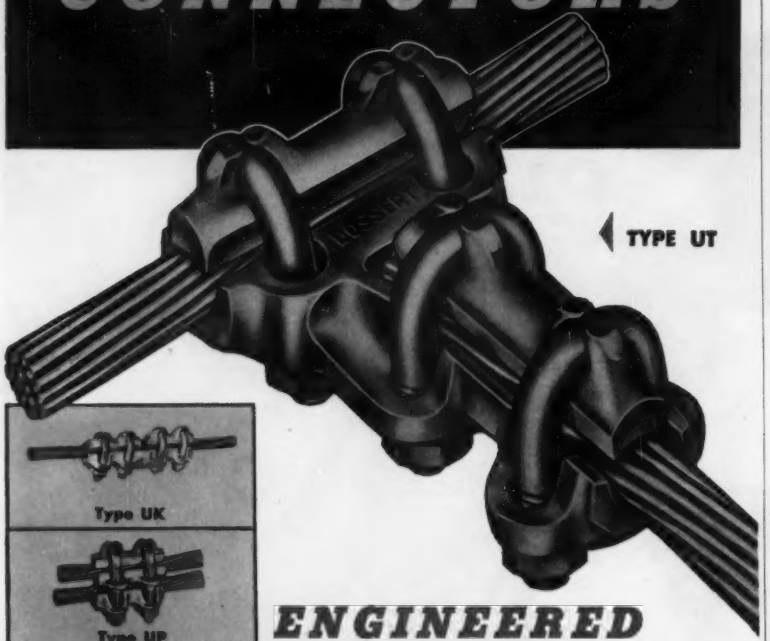
Fast to make fast!

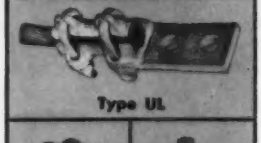
Safe, swift cable connections with

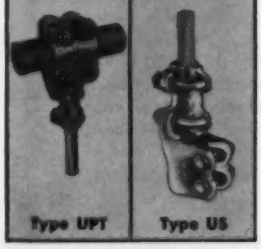
DOSSERT

U-BOLT

CONNECTORS







ENGINEERED FEATURES:

VARIABILITY
Fits many cable sizes, reduces number of connectors needed for given number of combinations of conductors.

HIGH CLAMPING ACTION
U-Bolts clear all conductors by close limits, supported by saddles through their full arcs. Minimizes bending action, makes U-Bolts subject to tensile stress only.

CABLE END RELIEF
Allows for distortion in free ends of strands, ample room for binding end of stranded cable if desired.

CONDUCTIVITY
High copper alloy with sufficient contact area to insure cooler-than-conductor operation under maximum load.

Available for aluminum or aluminum to copper conductors.

Excl. Canadian Distributor: W. S. Gerrie & Assoc. Ltd.
4158 Dundas St. West, Toronto 18, Ontario

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DOSSERT MFG. CORP.

249 Huron Street, Brooklyn 22, N. Y.

Catalogs-Bulletins

(*Continued from page* 182)

• **CONTROLS:** Line of sealed mercury-contact switches for heating, refrigeration, air conditioning, and industrial applications is described in 52-page Catalog No. 856. Operating ranges, adustment, differentials and ratings are given. Mercoid Corp, 4201 Belmont Ave, Chicago 41, Ill.

• **MOTOR STARTER:** Bulletin No. 1041 covers a high-voltage fused starter (Class 1041) for 2.2 to 4.8-kv squirrel cage and synchronous motors. The 8-page booklet gives specifications, cross section drawings and data on options. Nelson Electric Mfg Co, Tulsa, Okla.

• **ANNUNICATORS:** Design and specifications for a line of annunciators are contained in 26-page catalog. Selection and application data are included. Scam Instrument Corp, 3855 N. Kedzie, Chicago 18, Ill.

• **SIX-WHEEL TRUCKS:** Design and operating features for a line of conventional and cab-over-engine six-wheel trucks are given in 24-page Catalog No. CR-860-E. International Harvester Co, 180 N. Michigan Ave, Chicago 1, Ill.

• **AERIAL LADDER:** Detailed information on a 40-ft aerial ladder (Series 2100) is contained in a 4-page folder. The hydraulic ladder rotates 360 deg and elevates to 75 deg. J. H. Holan Corp, 4100 W. 150th St, Cleveland 11, Ohio.

TECHNICAL LITERATURE

THERMODYNAMICS—"Generalized Thermodynamic Properties of Pure Fluids" extends previous generalizations to include experimental data of compounds for which considerable pvT data are available. The 100-page report presents each thermodynamic property within a single chart and table for both gaseous and liquid states and for the two-phase region. A third parameter—the critical compressibility factor z_c—has been used to extend the generalizations to include most molecular compounds in the fluid state. Engineering Experiment Station, University of Wisconsin, Madison, Wis. Price $3.50.

HYDRAULIC STANDARDS—Tenth edition of "Standards of the Hydraulic Institute" constitutes a complete revision and rearrangement of engineering data and format. The book has 234 pages, loose leaf, 5-ring binder. Revision notification service is provided. Hydraulic Institute, 122 E. 42nd St, New York 17, N. Y. Price $4.75 in U. S.

ARC WELDING—Technical Data Card 155A summarizes various recommendations for joining tubing steels by arc welding procedures. The card indicates proper electrodes to use and provides information about preheating and post-welding heat treatments. Babcock & Wilcox Co, Tubular Products Division, Beaver Falls, Pa. No charge.

THRUST BEARINGS—Selection and application of commonly used thrust bearings for large vertical ac motors are outlined on a technical chart. The information applies to 200-hp motors and larger. Electric Machinery Mfg Co, 800 Central Ave, Minneapolis 13, Minn. No charge.

ON CRAWLERS
TO DIG SERVICE DITCH
ON TIME!

WORKS EVERY DAY, RAIN OR SHINE No "fair weather" machine, the full crawler-mounted 403 works in deep mud . . . sticky gumbo . . . the most adverse ground conditions. The 403 has greater stability, yet treads lightly to protect lawns and sidewalks.

LESS DOWNTIME—Tractor-type crawlers on the 403 are strong, dependable, trouble-free . . . last longer with less maintenance.

MORE PRODUCTION—Compact design means greater maneuverability in close quarters. Cuts up to 5 feet deep in 8 to 12 inch widths; 4 feet deep in 14 and 16 inch widths. Easily transported from job to job in a hurry on low-cost tilt-bed trailer.

GET ALL THE FACTS about how you can dig more ditch per dollar with a Gar Wood-Buckeye 403. See your Gar Wood-Buckeye Distributor or write to Customer Service Department, Gar Wood Industries, Inc., Wayne, Michigan.

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CONSTRUCTION MACHINERY
TRUCK EQUIPMENT

BOOKS

Books Received Since January 23, 1956

Spheroidal Wave Functions. By J. A. Stratton, P. M. Morse, J. Chu, J. D. C. Little and F. J. Corbato. Published by The Technology Press, Massachusetts Institute of Technology, and John Wiley & Sons, Inc, 440 4th Avenue, New York 16, N. Y. 613 pages, illustrated. Price $12.50.

Proceedings of the Ninth Annual Conference on the Administration of Research. By Northwestern University Technological Institute. Published by New York University Press. 107 pages. Price $4.00.

Lighting Made Easier

Light Calculations and Measurements. By H. A. E. Keitz. Published by Philips Technical Library, Eindhoven, Holland. 428 pages, illustrated. Price $7.50.

Comprehensive treatment of lighting is the aim of this book. Theoretical aspects, such as refraction and dispersion, photometric concepts, and methods of calculation all are covered. And its clear presentation seems to include nearly everything the illuminating engineer or physicist needs for his work.

Emphasis is on engineering rather than physics. Mathematics required is not too difficult, and copious diagrams explain many relationships which a casual reader might miss in equations. Theory required is generally included in simplified form. Readers who seek more theory can be guided by the bibliography.

Utility engineers whose duties include street lighting or service to commercial and industrial customers should find this book a useful text and reference.

How to Use Analogs

Introduction to Electric Analogue Computers. By C. A. A. Wass. Published by McGraw-Hill Book Co, Inc., New York 36, N. Y. 238 pages, illustrated. Price $6.50.

Rapid adaptation of analogue and digital computers to solution of utility system problems makes this new book a particularly worthwhile addition to the library of the young engineer.

It presents mathematical problem statements of a variety of systems amenable to analog computer solution. These are reduced to simple computing networks which introduce basic characteristics of components. Computing components are described and their limitations analyzed.

There is no comparable material available. It describes the set up of analog computers for solving a number of specific problems such as aeroplane flight with automatic control, and the motions of a charged particle in combined electric and magnetic fields.

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GALVANIZED STEEL
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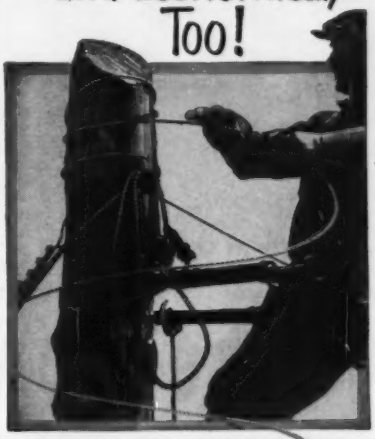
Strong...
to support pole structures under adverse ice and wind loadings.

Rugged...
to withstand the punishment incurred in construction and service.

Long-Life...
provided by famous *Crapo* Galvanized heavy, ductile, tightly-bonded zinc coatings.

and Economical, Too!



● Each size and grade of time-proved *Crapo* Steel Strand utilizes the superior tensile strength of steel to the fullest advantage. Next time, *specify Crapo Steel Strand* for guys, messenger and overhead ground wires . . . and *save on maintenance!*

REINFORCE and PROTECT YOUR CONDUCTORS with Preformed ARMOR RODS

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Contact your jobber of *Crapo* Galvanized Products or write direct for further information!

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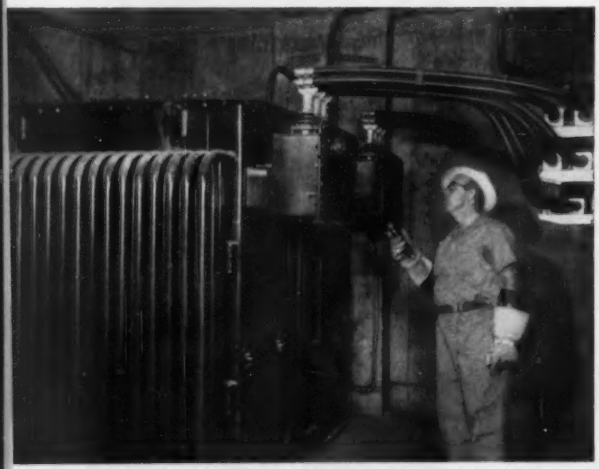
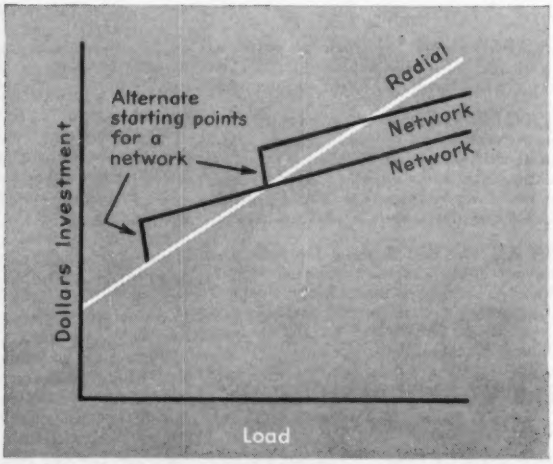
NETWORK TRANSFORMERS

LOAD GROWTH IN CHARLOTTE, N. C., particularly in the downtown area around the Jefferson Standard Life Insurance Building shown above, has been rapid in recent years. Expecting even more rapid growth in the future, Duke Power Company is already planning for eventual conversion to a secondary network system.

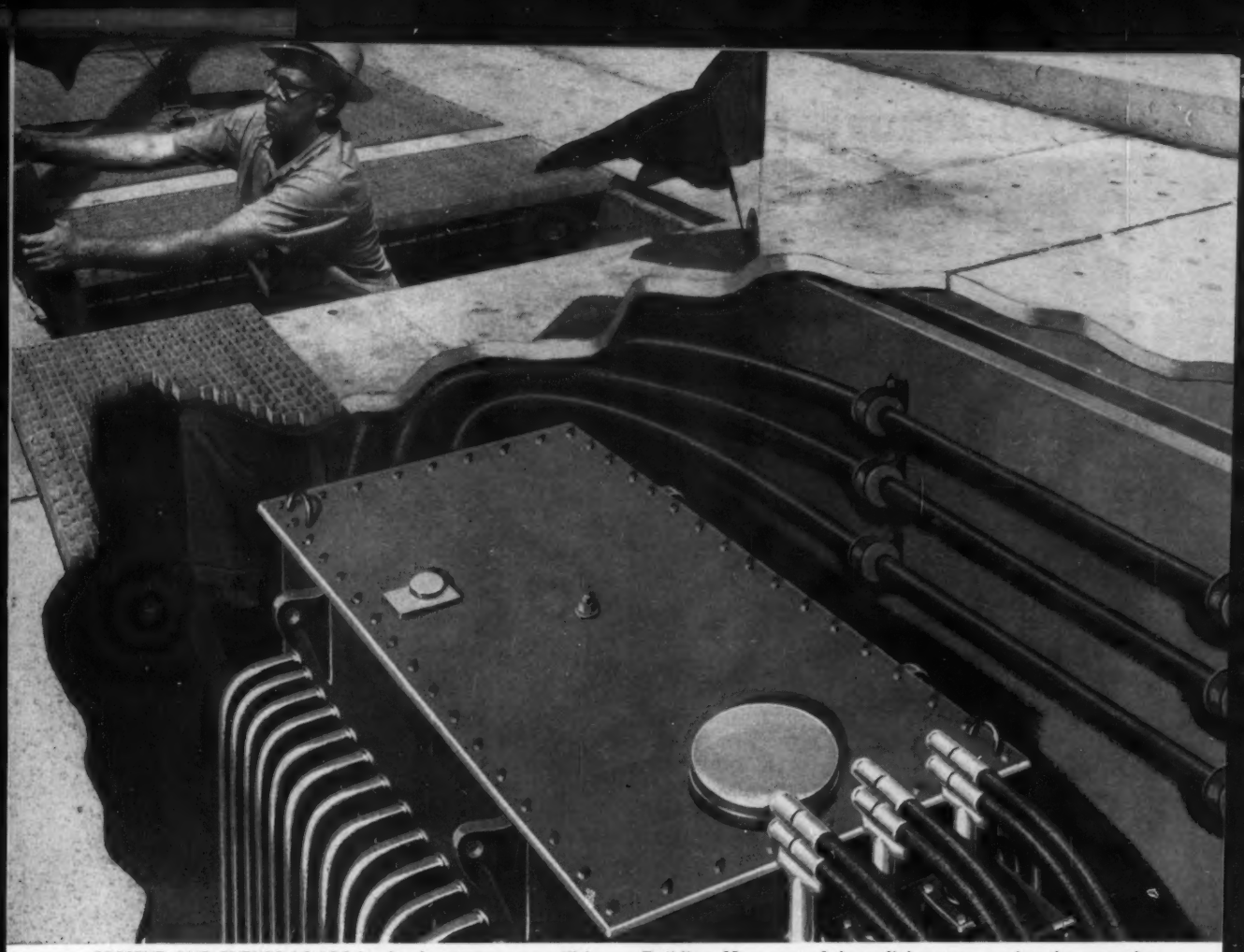
Duke Power Goes to Network



POWER is provided by two 1000-kva network transformers, installed in a vault on the present radial system. Compact units minimize vault size . . . submersibility protects against flood damage.



IT PAYS TO START A NETWORK . . . Future increases in capacity require less investment with a network system than with a radial system—the sooner you start a network, the lower its ultimate cost.



PRESENT AND FUTURE LOADS in the downtown area will be served by G-E network transformers like the two installed in the vault adjacent to the Jefferson Standard Life Insurance Building. Now part of the radial system serving the area, the transformers can be easily connected into a network system when it becomes desirable.

Transformers on Radial System

New installation in downtown Charlotte meets present loads, paves way for eventual conversion to secondary network system

In downtown Charlotte, N. C., the Duke Power Co. was faced with today's familiar problem—how to meet most economically the growing demand for power.

After careful study, and consultation with General Electric application specialists, Duke engineers installed G-E network transformers on the present radial system. Here are the three benefits gained:

1. **Maximum flexibility.** Duke engineers can continue to operate the radial system, or can reconnect into a network system if the load grows further.

2. **Low cost expansion in the future.** Cost of converting to a network will be low—the network transformers are already installed, there's provision for mounting network protectors at a later date, and cabling is the same. Cost of future expansions will be low—new load and new transformers can be added to a network system without making additional system studies.

3. **Increased dependability.** The transformers are underground, safe from buffeting. And they are submersible—important since water may flood the vault.

Savings for You—For help in estimating the savings a network makes possible, call the nearest G-E Sales Office, or write for Bulletin GET-2432. General Electric Company, Section 435-11, Schenectady 5, N. Y.

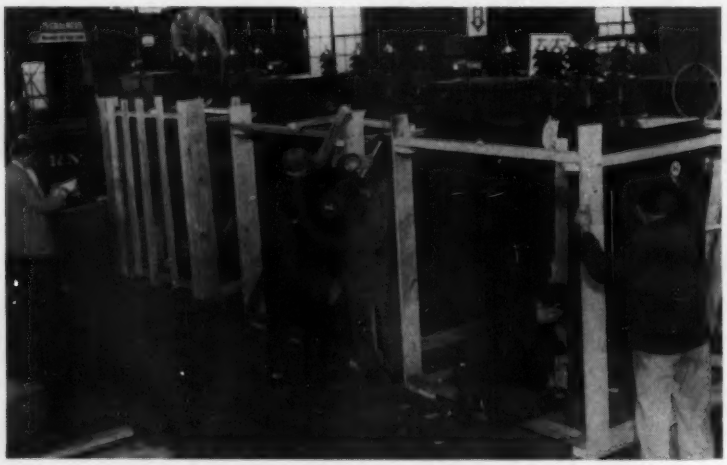
Progress Is Our Most Important Product

GENERAL ELECTRIC

Sangamo Builds Pole-Type Capacitor

This 300-kvar, 4,800-v capacitor equipment is Sangamo Electric Co's first factory-assembled pole-type unit. It is being examined by (left to right) James H. Patton, Sangamo's vice president; Howard Stites, electrical engineer of Central Illinois Public Service Co; and William Thacker, sales manager of Sangamo's Power Capacitor Division.

Galvanized steel framework, arranged for crossarm hanging, rigidly supports the capacitors. Ample ventilation is provided by the spacing of the capacitors, according to the manufacturer. An oil switch is included for capacitor switching. The unit is factory wired and bushings are shielded by insulating caps.



A-C Breakers Readied in Record Time

These three distribution breakers, each rated 14.4 kv, 250,000 kva interrupting capacity, went forward in half the normal delivery time. The breakers are shown being crated at Allis-Chalmers Boston Works for shipment to a southwestern installation.

Normal delivery time for this type of equipment is from eight to nine weeks. However these units were on their way to their destination a week ahead of the originally promised five-week shipment.

BPA Awards Contracts for Big Eddy Substation

Bonneville Power Administration recently awarded contracts for work on Big Eddy substation.

Contract for power system relay equipment went to General Electric Co on a bid of $84,006. John M. King Co of Tacoma, Wash., received the contract for construction of Big Eddy's switchyard additions, two relay houses, cable tunnels, oil house, and transfer track. The latter's bid was $416,600.

GE Slates 19 Generators for 1956 Delivery Abroad

Record overseas deliveries will be chalked up by the Turbine Division of General Electric Co in 1956. Nineteen steam-turbine-generator units totaling 648,525 kw in capacity will be shipped to 11 foreign countries. In addition, two units totaling 47,570 kw will go to Puerto Rico.

Spain will receive nearly one-half of the Turbine Division's total export of kilowatts in 1956, including the largest unit on the overseas order, a 125,000-kw steam turbine-generator. Another 125,000-kw unit is slated for delivery this year to Tokyo Electric Power Co.

In 1955 GE sent overseas 18 steam turbine-generator units totaling 273,000-kw capacity.

Two Developments Aid Control of Radio Fleets

Two recent developments are designed to improve operation of radio-controlled service fleets.

- General Electric Co has a "Personal Channel" system which allows a dispatcher to communicate with any radio-equipped car or truck without bothering others in the network. The system uses electronic tone selecting equipment to turn the mobile radio receivers on individually.
- Radio Corp of America has a radio dispatching system to give maximum fleet control. The system is built around a compact, tiered, 54-slot card rack which will enable dispatchers to determine at a glance the immediate destination, schedule, and personnel of each vehicle.

Westinghouse Ups Breaker Settings on CSP Transformers

Higher breaker trip settings for CSP distribution transformers have been announced by Westinghouse Electric Corp. The higher settings will boost normal overload capacity of the transformers by about 20% and emergency overload capacity by about 15%.

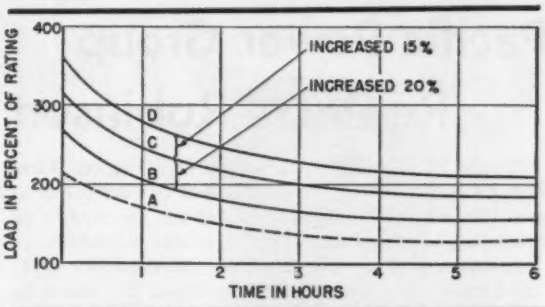
These higher capacities are obtained without sacrifice in service life, according to Frank L. Snyder, vice president of the company's Transformer Division.

Snyder said that the new settings are a result of 18 months of laboratory tests and two years test in the field. "Three utilities that have cooperated extensively in accumulating this field experience are the Long Island Lighting Co, Union Electric of Missouri, and Dallas Power & Light Co," he observed.

"Raising the breaker trip settings on the CSP transformer," Snyder said, "results in a boost of about 20% in overload capacity. That is, a 25-kva transformer with present breaker settings would trip off the line in 90 min when carrying about 47 kva under severe initial conditions. The same transformer set for the new higher trip levels will carry about 56 kva for 90 min under the same conditions. This additional overload capacity can be carried without sacrifice in service life."

Snyder pointed out that the significance to the electric utility industry in the higher breaker trip settings lay in the fact that "these higher breaker trip settings make possible greater use of a utility's investment and offer a welcome reduction in costly emergency service calls."

Another important advantage, according to Snyder, is that utilities will have greater flexibility in scheduling transformer change-outs. With this increased bandwidth between overload signal operation and breaker trip, a greater time can elapse before change-outs are necessary in areas where load is growing.



LOAD-TIME CURVES are for a typical Westinghouse CSP transformer following 75% load, 35 C ambient. A=signal light; B=former breaker trip; C=new breaker trip; D=new emergency trip.

M&M BRIEFS

Republic Flow Meters Co, Chicago, Ill., has purchased the power plant equipment division of Swartwout Co. Amount involved in the transaction was not disclosed. Republic is establishing a Swartwout Division to carry on engineering, manufacturing, sales, and service of Swartwout's steam specialties. The changeover is expected to be completed by March 1.

Reynolds Metals Co has had its nationwide, private-wire telegraph system doubled in capacity by Western Union. Installed in December, 1953, the system now provides communication between 59 Reynolds plants and offices in 47 cities. Circuits serving 14 cities have been doubled in capacity by duplexing to permit two-way simultaneous operation.

A. M. Castle & Co recently announced plans to construct a general office and warehouse in Chicago's suburban Franklin Park. The $4.5-million, 392,262-sq ft plant will occupy a 20-acre tract. The steel-distributing firm expects the plant to be ready for business early in August.

Cutler-Hammer, Inc, has completed a new plant in Los Angeles, Calif. The building will house manufacturing and warehousing facilities and the Los Angeles district sales office. The plant has a 31,500-sq ft floor area and is situated on a three-acre tract near the Santa Ana Freeway.

Wheelock Signals, Inc, is the new name of Signal Engineering & Mfg Co, manufacturer of relays, fire alarm systems, audible signals, code call systems and auxiliary equipment. Previously in New York City, the company has moved to new plant facilities and offices at Long Branch, N. J.

MANUFACTURERS' EARNINGS

COMPANY	PERIOD MONTHS ENDED		NET INCOME 1955	NET INCOME 1954	EARNINGS PER COMMON SHARE 1955	EARNINGS PER COMMON SHARE 1954
Baltimore & Ohio R.R.	12	Dec. 31(p)	$23,918,782	$14,528,789	$....	$....
Copperweld Steel Co.	12	Dec. 31(p)	2,365,459	703,150	2.81	0.88
Daystrom, Inc.	9	Dec. 31	1,295,000	997,000	1.45(b)	1.53(b)
Eaton Mfg. Co.	12	Dec. 31(p)	13,725,000	8,559,021	7.40	4.78
Federal Pacific Elec. Co.	6	Dec. 31	815,374	476,372	1.01	0.59(b)
General Motors Corp.	12	Dec. 31(p)	1,189,000,000	805,973,897	4.30	3.03
Gulf Oil Corp.	10	Oct. 31	166,768,000	143,088,000	6.26	5.37
International Harvester Co.	12	Oct. 31	55,501,000	36,304,000	3.60	2.24
Johns-Manville	12	Dec. 31	23,511,183	16,655,658	7.37	5.24
Kennecott Copper	12	Dec. 31(p)	125,615,418(a)	77,906,288	11.61	7.20
Porter (H.K.) Co, Inc.	12	Dec. 31	6,433,107	3,215,785	6.15	3.06
Rome Cable Co.	9	Dec. 31	1,370,000	644,000	2.86(a)	1.25(a)
Standard Oil Co of N. J.	12	Dec. 31(p)	717,000,000	585,000,000	10.96	9.56(c)
United States Steel Corp.	12	Dec. 31(p)	370,197,625	195,417,611	6.45	3.23(d)
Union Carbide & Carbon.	12	Dec. 31(p)	140,755,858	89,779,271	4.83	3.10

(a) Based on shares outstanding at close of period. (b) Based on shares now outstanding. (c) Based on average number of shares. (d) Adjusted to reflect the 2-for-1 stock split in 1955. (p) Preliminary statement. (s) After deducting flood costs of $11,903,585 for the year.

NEWS ABOUT PEOPLE

Pacific Power Group Reelects Robinson

Kinsey M. Robinson, president of Washington Water Power Co, has been reelected president of Pacific Northwest Power Co, a company organized for the purpose of developing large hydro projects in Pacific Northwest.

Robinson, who has served as WWP president since 1938, was formerly associated with Idaho Power Co, where he held numerous positions before his election as vice president and general manager in 1933. He was named president of the utility in 1934.

As president of WWP, Robinson late last year spearheaded the utility's campaign in Stevens County, in which voters chose WWP over the public utility district by a 72% majority.

Commenting on Pacific Northwest's proposed Pleasant Valley and Mountain Sheep projects totalling 1,446,000 kw, Robinson said the firm "is ready and able to launch a full-scale construction program at the Snake River sites . . . as soon as federal approval is granted."

Pacific Northwest, composed of Montana Power Co, Pacific Power & Light Co, Portland General Electric Co, and WWP, applied to Federal Power Commission last September for a license (EW, Oct 3, p 82).

K. M. ROBINSON

Reelected as vice presidents of the combined firm were: Paul B. McKee, president of PP&L; Thomas W. Delzell, chairman of the board, PGE; and J. E. Corette, president of Montana Power.

PP&L Elevates Walter Morton

Walter B. Morton, Pennsylvania Power & Light Co assistant electrical engineer, has been appointed electrical engineer. A former vice president of AIEE, he joined PP&L in 1945 as station engineer after prior experience in jobs ranging from draftsman to field engineer with Pacific Gas & Electric Co, Dixie Construction Co, and Philadelphia Electric Co. He has served as assistant PP&L engineer since 1954.

Morton succeeds Stanley C. Townsend, electrical engineer since 1941 and manager of the firm's atomic power activities. Townsend will continue to direct the atomic power department, the post he has held since 1955.

W. B. MORTON

Appoints Merrell Chief Engineer

Edwin J. Merrell has been designated chief engineer of the Habirshaw Cable and Wire Division of Phelps Dodge Copper Products Corp. He replaces William A. Del Mar, who is retiring from active executive work after 38 years of service as chief engineer to become consulting engineer for the company.

Merrell, an engineering graduate of Princeton University, has been associated with the Habirshaw Division since 1936 and was appointed director of electrical research in 1947. Merrell is a member of American Institute of Electrical Engineers and is author or co-author of six papers for the institute.

Del Mar, who will now devote his time to technical matters, is a past vice president of AIEE and has been a member of its Standards Committee since 1917.

E. J. MERRELL

He's coming to help you

He is a Bell System communications engineer. His purpose is to help you speed your operations, cut your costs and improve your service—by making sure your communications meet your exact requirements.

The Bell System offers a wide variety of private line services, including telephone, teletypewriter and mobile radio systems. And the Bell System tailors these facilities to meet specific individual needs, so that you maintain high-speed contact between your various departments, branches, factories, warehouses, as well as between you and your suppliers, customers, distributors and shippers.

Why not let a Bell System communications engineer make a study of your communications requirements and recommend the kind of service, or a combination of services, which will best meet your specific needs?

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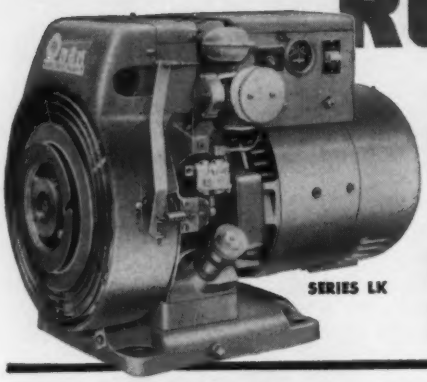

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New ONAN 2,000-WATT ELECTRIC PLANT

Put it to work on your toughest jobs!

PORTABLE POWER

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PRIMARY POWER

Runs longer in continuous service. Dependable, economical.

Built to stand up where others can't! Powered by Onan 4-cycle, one-cylinder gasoline engine with Stellite-faced exhaust valve, longer-wearing bearings, efficient air-cooling. Onan all-climate generator is direct-connected. Compact, lightweight. Conservatively rated; economical operation. 115 or 230 volts, A.C. Recoil starter, electric starting, or automatic start and stop. Wide range of accessories. Other Onan models: 500 to 50,000 watts.

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All new units with these most important features: • Portable • Rugged • Weather Proof • Field Tested for over a year by one of the east coast's largest gas and electric companies.

- **MECHANISM TEST SET MODEL C-13** provides tests for the motor mechanism, desensitizing relay, and circuit breaker in General Electric or Westinghouse Network Protectors.
- **PHASING TRANSMITTER MODEL E C-25** provides low voltage system for tracing individual wires in shielded cable and for determining correct phase.
- **POLATROL RELAY TEST SET MODEL C-109** provides adjustable voltage for testing all DC Polatrol Relays used in street lighting systems.
- **VOLTAGE QUADRUPLE SERIES TEST SET** provides high voltage test for series street lighting systems. Permits check at any time, day or night, and at any location.

RELAY TEST SET MODEL C-15 provides quick, easy method for testing and adjusting the master relay in either General Electric or Westinghouse NETWORK PROTECTORS. Also for testing the current transformers.

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PERSONAL BRIEFS

Duane Walrafen has been appointed corporate officer of Black Hills Power & Light Co. He formerly was chief engineer and director of the public utility division of Kansas Corporation Commission.

Indianapolis Power & Light Co has promoted **James D. Blythe,** engineer and special representative, to the position of administrative assistant. Blythe had also served as general manager of Mooresville Public Service Co, Inc, Ipalco subsidiary, and is succeeded in that post by **Zane G. Todd.**

Arthur H. Cheney has been named rate and research engineer for Central Vermont Public Service Corp to succeed the late **Ernest C. Hathaway.** The position of Director of Industrial Development, also held by Hathaway, has not yet been filled, but the utility has named **Nat Tyler,** general sales manger, to assume temporary responsibility for the activities of the department.

Gustavus H. Stewart, former head of South Carolina Extension Service's agricultural engineering department, has been named industrial development agent for Carolina Power & Light Co, with headquarters in Florence, S. C.

Monongahela Power Co's **W. Carl Huffman** has been named manager of the company's Mannington district to fill the position made vacant by the death of **David Matheny.** Since 1953 Huffman has served as a special representative, assigned to a redistricting study of the company's territory.

Retirement of **Lucius E. Steere, Jr,** as electrical engineer has been announced by Potomac Electric Power Co. Steere, a 36-year Pepco veteran, has served as assistant electrical engineer and engineer, inside plant, and was named electrical engineer in 1953.

Four Oklahoma Gas & Electric Co men moved up after Shawnee Division Manager **Ralph Kumler's** retirement. **W. L. Counts,** former western division service manager, succeeds Kumler. Replacing Counts is **Shelby Hill,** division engineer, and **Roy Lappin,** Shawnee division engineer, will assume Hill's western division post. Engineer **Edward J. Heinze** succeeds Lappin.

Eastern Shore Public Service Co of Maryland has appointed **M. Franklin Horner** as district manager at Crisfield to replace **Sidney Burtman** who has been transferred to the Oxford district.

J. T. Jones has been promoted to assistant general manager of Empire District Electric Co (Mo.), and will continue to direct the merchandise sales and service department as well as the activities of the company's district offices.

Edward J. Hart has been appointed president of the New Jersey Board of Public Utility Commissioners.

Army Corps of Engineers' **James F. Grafton** has been appointed project engineer for Eagle Gorge Dam. He formerly served as resident engineer at Albeni Falls Dam on the Pend Oreille River in northern Idaho.

Iowa State Commerce Commission has elected **John A. Tallman** to succeed **Carl W. Reed** as chairman for 1956. **George L. McCaughan** was appointed executive secretary.

Aaron L. Jacoby, Brooklyn Democrat, has been confirmed by New York Senate as Public Service Commission member.

Chicago Lighting Institute has elected the following to serve as officers during 1956: **O. A. Hill,** superintendent of light bulb service, Commonwealth Edison Co, as president; **Frederick H. Heintz,** midwest sales manager, Lighting Division of Sylvania Electric Products, Inc, as vice president; **R. J. Diefenthaler,** sales administrator, Chicago sales district, Large Lamp Department, General Electric Co, as secretary-treasurer; and **Carl W. Zersen** was re-elected as managing director and assistant secretary-treasurer, a post he has held since 1939.

Ernest G. Swigert, president of Hyster Co, has been elected national vice president of National Association of Manufacturers. He is also vice president and director of Electric Steel Foundry Co.

Elton E. Staples, executive vice president of Hevi Duty Electric Co, has been elected president of the Industrial Heating Equipment Association.

(*More Personal Briefs on p.* 194)

CF&I GALVANIZED STEEL STRAND

for guy, messenger and ground wires

You'll find that an ever-increasing number of public utilities, transit companies and similar organizations are depending upon CF&I for their guy, messenger and weldless overhead ground wire requirements.

That's because CF&I offers a complete line of top-quality galvanized 7-wire* twisted steel strand that's carefully quality-controlled by CF&I throughout *every* stage of production. This quality control is important to you! It's your assurance that CF&I Strand is always made from steel that has exactly the right chemical and physical properties to fill your needs . . . and that this steel is carefully drawn, galvanized and stranded into a product that'll give years of satisfying service.

Next time you need strand, talk over your requirements with your nearby CF&I representative. He'll be happy to give you complete details on the CF&I Strand that's best for your job.

CF&I Strand For Public Utility And Similar Applications Fully Meets Or Exceeds The Latest Applicable ASTM Specification (A-122 For Guy And Messenger Wire; A-363 For *Weldless* Overhead Ground Wire).

*Also available in 3-wire construction.

3740

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THE COLORADO FUEL AND IRON CORPORATION · Albuquerque · Amarillo · Billings · Boise · Butte · Casper · Denver · El Paso · Ft. Worth · Houston · Lincoln (Neb.) · Los Angeles · Oakland · Oklahoma City · Phoenix · Portland · Pueblo · Salt Lake City · San Francisco · Seattle · Spokane · Wichita

ENCLOSED CLUTCH CAN'T STICK OR FREEZE *Ever!*

WINCHES

Put an advanced Gar Wood 7000 lb. winch on your utility truck and you'll put an end to clutch trouble. All moving clutch parts are *fully enclosed and running in oil* . . . can't stick, freeze or rust because weather and dirt can't get in!

You'll put an end to the hazard of sudden slippage, too. Gar Wood's self-energizing safety brake and time-tested back-draft clutch give your operator much safer control of the load.

And that's not all! Gar Wood winches feature stress-free, tempered aluminum alloy housings that are lightweight, rust-proof, built for longer life . . . built-in rope clamp for easier attaching and changing of rope, better spooling . . . self-contained ball-bearing mounted worm shaft for smoother operation . . . extra rugged base angles for an extra margin of safety.

Get all the facts about Gar Wood 7000 lb. winches, available as standard or low mount. Call your Gar Wood-St. Paul distributor or mail the coupon below.

GAR WOOD INDUSTRIES, INC.

Wayne, Michigan • Richmond, Calif.

MAIL FOR SPECIFICATIONS

Customer Service Department EW-1
Gar Wood Industries, Inc., Wayne, Michigan

Please send me specifications on Gar Wood 7000 lb. winches.

Name _____

Title _____

Company _____

Address _____

New officers for Iowa Utilities Association for 1956 are **L. G. Hawkins,** assistant general manager of Peoples' Gas & Electric Co, as president; **Carl A. Hummel,** Interstate Power Co, as first vice president; and **Robert Greeleaf,** Iowa Southern Utilities Co, as second vice president. Retiring president is **J. T. Schilling,** Iowa Power & Light Co.

General Electric Co has appointed **Thomas J. March** as sales manager of electronic components department with responsibility for sales of the department's electronic products to GE and other manufacturers. He succeeds **Roy L. Merwin, Jr.**

General Electric Co has named **Robert C. Wilson,** manager of engineering of distribution assemblies department, as manager of marketing for the department . . . **D. S. Beldon, Jr,** has been appointed manager of national accounts for GE's housewares and radio receiver division.

Graybar Electric Co has appointed **George J. Kennedy** as general commercial sales manager to succeed **H. P. Litchfield** who has retired. Kennedy is former assistant commercial sales manager.

Newly elected chief engineer of Allis-Chalmers Manufacturing Co's Pittsburgh Works is **William M. Terry, Jr,** former assistant chief engineer at Pittsburgh. He replaces **P. E. Cook,** who becomes consulting engineer and assistant to the general manager.

Westinghouse Electric Corp has appointed **Walter E. Benoit** executive assistant to the manager of the Baltimore Divisions. **W. I. Bendz** succeeds him as manager of the electronics division.

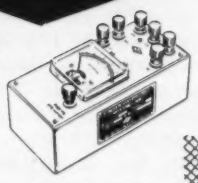
The appointment of **Russel A. Schlegel** as manager of industrial product sales has been announced by Weston Electrical Instrument Corp, subsidiary of Daystrom, Inc. He will supervise the sale of Weston industrial instruments in domestic markets.

Frederic A. Hirsch, head of Marcus Transformer Co's dry type transformer division, has been promoted to the position of plant superintendent, and will direct all manufacturing operations of both dry and liquid filled units.

Investigate these METER TESTING ACCESSORIES

Now in use by Leading Utility Companies

FIELD TEST SET



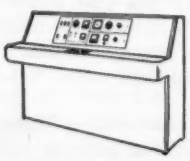
This instrument is a simple, inexpensive, portable means whereby the customer's current transformer installation may be quickly checked for basic sources of trouble.

POTENTIAL SWITCH for METER TESTING

This is a special form of the well-known snap action Micro Switch; needs only 6 ounces of pressure to operate it; long lived — modified to suit the requirements of manual control of rotating standard potential.

INSULATION TESTER

Developed in response to the need for an insulation testing device that would have: maximum safety, instantaneous indication, direct reading in megohms without calculations, ability to discriminate between a complete insulation breakdown and leakage through insulation, portability and compactness.



METER TESTING POWER SUPPLY

The purpose of this apparatus is to furnish a stable and controlled source of single phase potential and single phase current for general testing purposes, together with means for adjusting the phase angle so that power may be supplied at any desired power factor, leading or lagging.

Write for Complete Information

EASTERN SPECIALTY CO.
PHILADELPHIA 40, PA.

New general sales manager of Brown Co's Paper and Paper Products Divisions is **Gilford F. Henderson,** formerly manager of the Paper Sales Division. **Harold E. Moley** becomes sales manager of the Paper Division, and **Melvin F. Pray,** manager of the Division of Markets, will also manage sales of the Consumer Products Division.

John D. Benedito has been appointed general sales manager of Bakelite Co, plastics division of Union Carbide & Carbon Corp, succeeding **H. K. Intemann** who becomes executive vice president of Electro Metallurgical Co, another Carbide division.

Sylvania Electric Products, Inc, has appointed **Frank M. Thomas** manager of equipment development for its Electronics Division. He was formerly manager of equipment engineering for Sylvania's Atomic Energy Division . . . **Merle W. Kremer** has been appointed assistant general manager of the Parts Division of Sylvania Electric Products, Inc, and continues his present duties as general manufacturing manager.

Philco Corp's Appliance Division has designated **Robert A. Houtz** as sales manager of builder sales.

Scott Vrooman has been named assistant manager of sales for the Chicago plant of Joseph T. Ryerson & Son, Inc. Vrooman, manager of inside sales since 1954, is succeeded in that post by **Donald E. Woodruff,** formerly a sales representative.

Reynolds Metals Co has appointed **James Mac Intyre** plant engineer at its Troutdale, Ore, plant, and has named **Lester Wolgast** electrical superintendent.

General Electric Co's Trumbull Components Department has appointed **John A. Kelly** as marketing administration specialist, and **James E. Van Effen** succeeds him as manager of commercial service. Van Effen was previously sales manager of the Chicago district . . . GE has named **Dr. George E. McCullough** as manager-process development for its Chemical Development Department.

Westinghouse Electric Corp has appointed **Richard D. Hartsig** manager of contract sales for the air conditioning division.

(*More Personal Briefs on page* 196)

Gentle Charging for LONGER Battery Life...

With Control Corporation's

Automatic Battery Chargers

Extend Battery Life for Power Companies from Coast to Coast

Automatic *Controlled* Charging . . . prolongs battery life. Every 60 seconds the automatic control tests the battery and makes a *small* adjustment in charging rate—according to the battery's need. In this way, batteries easily adjust themselves to the new charging rate without gassing, sulphation or unequal build up.

The Control Corporation's automatic charging system is a real battery "lifesaver".

Control Features

Non-Electronic Voltage Regulator . . . No tubes to burn out or replace. The low torque, slow speed motor drives the Variac to control voltages with high efficiency.

Output held within 1% . . . even though line voltage varies up to 10%!

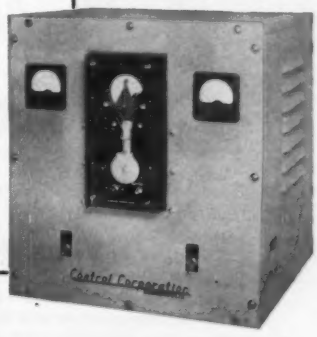
Cells build up evenly . . . under the slow, steady, controlled charging rate.

Lifetime Selenium Rectifiers . . . chosen for their exceptional dependability and long life. Rectifiers are convection cooled and protected thermostatically for utmost dependability.

Top Quality Components . . . each one chosen for its proven service, long life and dependability.

Three Way Protection:

- Overcurrent protection . . . with air type circuit breakers.
- Thermostatic protection . . . another plus safety feature to assure controlled output under abnormal load conditions.
- 1500 volt Hi-Pot . . . gives complete protection and excellent isolation.



Behind the scenes...

The heart of the Control Corporation's Automatic Charger which selects the Best charging rate every 60 seconds . . . it's a real battery lifesaver!

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Control Corporation
The nameplate of Quality
MINNEAPOLIS

• Super-Trol • Peak-Trol • Telemetering • Battery Chargers • Carrier Current

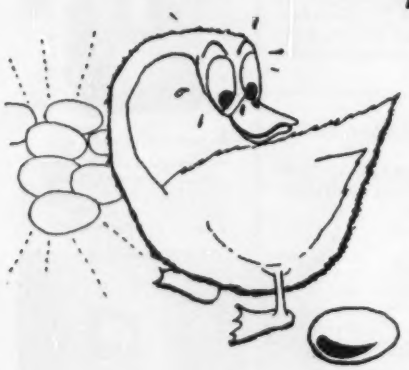
PAGE chain link FENCE
America's First Wire Fence—since 1883

• Security against the ever-present hazards that can damage or destroy property, or injure persons, is a responsibility to assign to PAGE Fence. Whether you choose heavily galvanized Copper-Bearing Steel, corrosion-resisting Aluminum, or long-lasting Stainless Steel, PAGE Fence is quality controlled from raw metal to rugged fence erected on metal posts deep-set in concrete. Available are 8 basic styles, varied by heights, types of gates, top rails, and barbed wire strands for added security. Finally, your PAGE Fence will be expertly erected by a reliable, technically trained firm. For important fence data and name of nearest PAGE firm—

Write to PAGE FENCE ASSOCIATION in Monessen, Pa., Atlanta, Bridgeport, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia or San Francisco.

PRODUCT OF PAGE STEEL & WIRE DIVISION OF AMERICAN CHAIN & CABLE COMPANY, INC.

all that glitters...



. . . is not necessarily gold, or for that matter, gold-plated. Take photoelectric lighting controls, for example. A low *price* tag may make one *look* like a big, shiny bargain — but it tarnishes pretty fast when the maintenance bills begin piling up.

Fisher-Pierce controls, on the other hand, honestly offer the advantage of first cost offset by savings in wiring, labor, materials and minimum maintenance. (One typical electric company*, who made their initial installation in 1946, now has more than 3000 Fisher-Pierce controls in service. They report low installation costs and during the 12 months of operation in 1953, the failure rate experienced was 2.29% of all units in service.) Net result in the long run is that *dependable* F-P control costs no more than the seeming "bargains."

**Name on request*

Fisher-Pierce will be glad to send you technical data and information on request. Write today.

THE FISHER-PIERCE CO., INC.
82 Pearl Street, So. Braintree, Boston 85, Mass.

EXPORT:
Philips Export Co., 100 E. 42nd Street, New York 17, N. Y.
In Canada:
Northern Electric Co., Ltd.

New additions to Allis-Chalmers electrical application department are **W. G. Williams** and **R. N. Gustafson,** formerly with Keleket X-Ray Corp and Carbide & Carbon Chemicals Co, respectively.

L. L. Duncan has been designated sales manager of the Unit Heater and Mill Supply Division of D. J. Murray Manufacturing Co. He will also continue his former duties as director of advertising and sales promotion.

Miss Frances M. Michael is new manager for Hotpoint Home Economics Institute replacing **Miss Helen Kirtland** who will direct "Live Better . . . Electrically" consumer activities.

OBITUARY

William Laurence Mather, 55, president and manager of Nantucket Gas & Electric Co, died recently in his Nantucket, Mass., home.

Consultant Board Named for Columbia River Study

A board of consultants for the Columbia River review study being conducted by the North Pacific Division, Army Corps of Engineers, has been selected from engineering firms and power companies, according to Brig. Gen. L. H. Foote, division engineer.

Board members are Calvin V. Davis of Harza Engineering Co, Chicago; Walter H. Huber of Huber and Knapik, San Francisco; Hibbert M. Hill, chief engineer of Northern States Power Co, Minneapolis; and Samuel B. Morris, general manager and chief engineer, Los Angeles Department of Water and Power.

Last fall Congress delegated the Corps to review the Columbia River 308 report and revise it as needed for orderly growth and development of the region.

One of the most important aspects of the review studies with which the board will be concerned is development of hydroelectric resources of the Columbia River, particularly their integration with steam or nuclear power generation in the next 15 to 30 years. Completion of the revised report is expected to take about two years.

Rescued from

graveyard by

G-E Service Shop

Get your obsolete distribution transformers back on the pole again—as good as new! Just call your local G-E Service Shop. We'll rebuild them ...uprate them 40% or more ...and return them with new-transformer warranties. There are 31 G-E Service Shops throughout the country—one near you. 451-31

Progress Is Our Most Important Product

GENERAL ELECTRIC

SALES ASSIGNMENTS

COMPANY STAFFS

Line Material Co has assigned R. W. Kelly and W. F. Oberschelp field engineering positions in Alabama and Pennsylvania respectively. Kelly, formerly sales application engineer, replaces C. W. Ashby, who has resigned. Oberschelp will supplement Field Engineer C. H. Johnson's efforts to provide increased service in eastern Pennsylvania.

Minneapolis-Honeywell Regulator Co's Industrial Division has assigned 21 new sales engineers to 19 branch offices located in 18 U. S. cities and one Canadian city. They are: William Bater and Robert W. O'Reilly, Philadelphia; David B. Beasley, Toronto; Walter E. Biewer and Robert E. Day, Los Angeles; Robert J. Byers, Milwaukee; A. P. Ciprari, International Division, New York; Alan L. Colter, Buffalo; John L. Dyer, Cincinnati; Merton H. Fischer, International Division, Minneapolis; Michael N. Francher, Syracuse; Eugene D. Haugen, Seattle; Charles C. Hulsey, Columbia; Charles B. MacRae, Houston; Robert J. Owen, Cleveland; John B. Prouty, Columbus; Harvey F. Renee, Indianapolis; Bertram R. Robinson, Union; Russell W. Skinner, Pittsburgh; Jack D. Stickley, Oklahoma City; and Richard E. Swenson, Twin City.

Okonite Co's new northwest branch manager is James B. Caldwell, Jr, who transfers from the Los Angeles office to Portland March 1. He replaces John D. Fess, now transferred to Pittsburgh. Edwin R. Conklin, former resident representative in Seattle, will open offices there March 1 to take care of Washington state.

Sprague Electric Co, upon retirement of New England sales representative Harrison Reynolds, has opened its own sales office in Newton, Mass., to serve the Boston area. William F. Arnold, Sr, has been named manager of the new office.

Sylvania Electric Products, Inc, has appointed Robert S. Rogers as national accounts lighting representative with responsibility for the sale of lighting products to companies whose activities are located in more than one Sylvania sales district. His headquarters will be located in Detroit.

REPRESENTATIVES

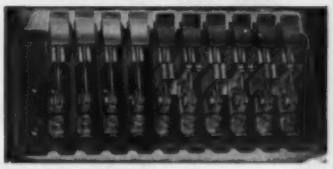
Automatic Switch Co has named Leen's Electric Motor Service as stocking distributors of Asco electromagnetic controls in Maine. Asco has also announced the change of address of their representative, Glidden Engineering & Equipment Co, from New Orleans to Douglas Park, Jefferson Parish, La.

Subox, Inc, has designated Waltham, De Witt & Krusi, San Francisco, as representatives for the northern section of California.

THE STATES COMPANY

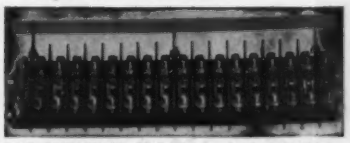
EXCLUSIVE STATES FEATURES

on ALL TEST BLOCKS TERMINAL BLOCKS TEST TABLES



SMK TEST BLOCKS. Solid Base Type—over 2,000 combinations of pole arrangements.

- *New Safety Grip Handle assures safer, easier gripping*
- *Blade shaped to enter jaw at right angle permitting maximum pressure at jaw contact.*
- *Large selection of pole arrangements.*
- *Nickel Corrosion-Resisting Finish insures good contact, attractive appearance.*
- *Angle Bent Studs permit quick changing of front connection.*



NT TERMINAL BLOCK. Exclusive Sliding Link feature permits checking circuit at any time without disturbing permanent wiring.

METER TEST TABLES

FORM "HAPBL" TEST TABLE—EXCLUSIVE 4 lever action on socket meter contactor. Positive element selector switch for testing two or three element meters plus many other features.

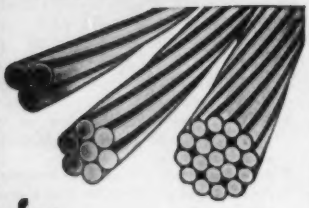
THE STATES COMPANY
19 New Park Ave., Hartford, Conn.

I am interested. Please send further information on:
☐ Test Blocks ☐ N.T. Terminal Blocks ☐ Test Tables

Name ..... Title .....
Name of firm .....
Address .....
City ..... Zone ... State .....

ACCO Quality

PAGE Stainless Steel Strand



for Severe Service Conditions

PAGE Stainless Steel Strand is equally versatile for ground, guy and catenary applications. Its higher tensile strength, corrosion-and-abrasion resistance, elastic limit and strength-to-weight ratio make it your first choice! Its lower cost per year of use means long-range economy.

Write us at Monessen, Pa., for complete information

ACCO

Monessen, Pa., Atlanta, Chicago, Denver, Detroit, Houston, Los Angeles, New York, Philadelphia, Portland, Ore., San Francisco, Bridgeport, Conn.

PAGE STEEL AND WIRE DIVISION
AMERICAN CHAIN & CABLE

for Better Value

NW Hydro Hassle

. . . is settled as Puget Sound P&L agrees not to contest Douglas PUD's FPC development license in exchange for power from Columbia project

Puget Sound Power & Light Co of Seattle, Wash., and the Douglas County PUD of Bridgeport, Wash., have reached agreement in a controversy as to which should have the right to build a 600,000-kw hydro project at the Wells site on the Columbia River north of Wenatchee, Wash.

The private power company has agreed to withdraw as an applicant for a Federal Power Commission license, in return for an option to buy, at cost, at least half of any available power from the dam, after the PUD meets its own requirements and any that might develop from a contract with Kaiser Aluminum & Chemical Corp.

Aluminum Plant Considered

Kaiser is examining the project to determine whether it wants to underwrite the development, in exchange for part of the power. Rumors persist that Kaiser will build a multi-million dollar aluminum reduction plant in Douglas County this year.

The FPC has granted the PUD a permit for the project but Puget Power protested the grant. Accordingly, FPC had scheduled a re-hearing for Feb. 6.

Goal Serves Public Interest

Frank McLaughlin, Puget Power president, and George D. Hamilton, PUD chairman, issued a statement which declared:

"In view of the predicted power shortage in the 1960's and with many projects stymied by controversy, the over-riding consideration is that the public interest be served by prompt, constructive, and cooperative action in power-resource development. This is what we seek."

The agreement with the Douglas PUD is the second Puget Power has reached with a PUD this year. Earlier, the company sold its share of Rock Island Dam, downstream on the Columbia, to the Chelan PUD and agreed to join with Chelan in development of the Rocky Beach Project, down-

WALKER SELENIUM RECTIFIERS
INSTALL THEM — FORGET THEM
Engineered for Extra Years of
AC TO DC POWER CONVERSION

LOW COST, QUIET, HIGHLY EFFICIENT, LONG LIFE NO MAINTENANCE

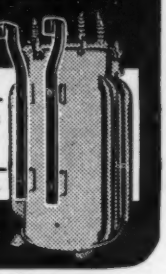
Walker Selenium Rectifiers are engineered and built to give *extra* years of service and inexpensive operation. They are highly efficient, have a power factor of 97% and a DC ripple of approximately 4%. All Walker Rectifiers are low priced. Only the highest quality components are used. Any number of rectifiers may be paralleled. Write for full details, today.

The Walker Division
NORMA-HOFFMANN BEARINGS CORPORATION
Stamford, Connecticut

THE WALKER DIVISION
NORMA-HOFFMANN BEARINGS CORPORATION
Stamford, Connecticut

THIEL
TRANSFORMER HANGERS

MODEL	C-1	C-3
TRANSFORMER	75-100 KVA Single-Phase	75-112½ KVA Three-Phase
WEIGHT	46 lbs.	100 lbs.



● Thiel Hangers are made according to NEMA specifications—heavy gauge steel construction, hot-dip galvanized for dependable service and long life. Two styles complete with galvanized bolts and nuts. In stock for immediate delivery.

T-TYPE HANGERS
In two sizes. For 3-50 KVA 1-Phase and 9-45 KVA 3-Phase transformers.

HANGER KICKERS
In sizes to fit T-type hangers.

THIEL TOOL AND ENGINEERING CO., INC.
1417 No. Market St. • St. Louis 6, Mo.

Puget Sound P&L

(*Continued from page* 198)

stream from the Wells site.

Meanwhile, the Grant County PUD reported "progress" in reaching agreement with prospective purchasers of power from its proposed $362-million Priest Rapids Project, still farther downstream on the Columbia. The PUD had distributed contracts to the prospects in December, but private power companies and municipal utilities alike objected to the form of the contracts. Representatives of all interests were meeting at Seattle, Wash., in an effort to reach agreement.

Nuclear Fuel Cost Target Set at 2-3 Mills per Kwhr

Present goal of the Atomic Energy Commission's Power Reactor Development Program is nuclear fuel costing no more than 2-3 mills per kwhr—a figure a long way from costs indicated by present technology.

AEC Reactor Development Chief W. Kenneth Davis put forth the target figure recently at a classified power reactor fuel processing symposium at Idaho Falls. In his speech, Davis urged the chemical industry to get into the power program by planning fuel processing plants. He said AEC wants to get private fuel processing on the road as part of a self-sufficient privately owned and operated atomic power industry.

So Cal Ed's Atom Power

First private utility to distribute electricity generated with the aid of a non-military reactor will be Southern California Edison Co. The utility recently received Atomic Energy Commission approval to enter into an agreement with North American Aviation's Atomics International Division to use surplus heat from the sodium graphite reactor now being built by North American in the Santa Susanna mountains 30 mi northwest of Los Angeles. Under the agreement, the utility would design, construct, and operate a heat exchanger and turbogenerator with a capacity of about 7,500 kw. The reactor is a joint AEC-North American nuclear energy project.

PLM Type AC 600-v Terminator for armored cable

happy ending
FOR ARMORED CABLE RUNS

TERMINATORS from PLM

Type ACS Terminator for installations to 15 kv

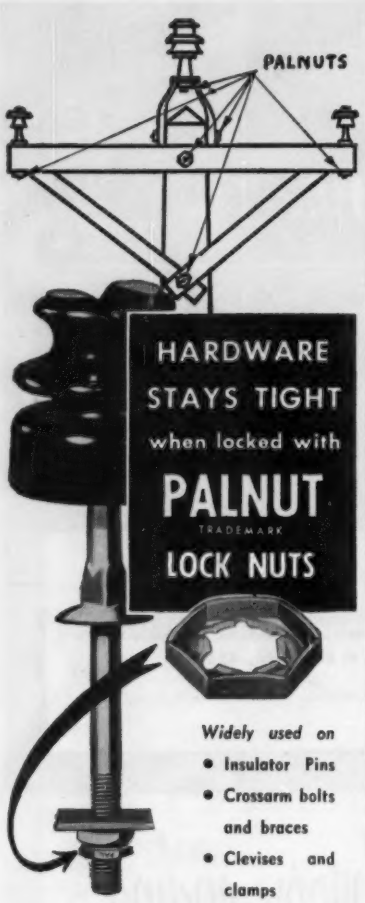
Type BAC Bracket for wall or ceiling mounting

● Planning is easy...installation easier...with armored cable fittings from PLM! PLM Terminators are made for installations to 15 kv...in cast aluminum or bronze...eliminate need for bulky, costly potheads in many applications. PLM Unit Package Kits speed up the job, too...insure correctly designed terminations and splices at every point.

Put PLM in your plans for quick action on both standard and special needs. Write for catalog.

PLM Products, Inc.
3873 West 150th St. • Cleveland 11, Ohio

WIRE AND CABLE FITTINGS AND ACCESSORIES
Armored Cable Terminators • Splicing and Terminating Kits • Conduit Ventilators



• Eliminate checking and re-tightening
• Eliminate radio interference due to loose hardware

Every bolt-and-nut assembly locked with PALNUT Lock Nuts stays tight, despite weather, wind, stress and vibration. PALNUTS, tightened on top of the regular nuts, prevent loosening and falling off. Very low in cost — easily, speedily applied — require little space — may be used on new or existing assemblies. Hot dip galvanized, silicon bronze and other materials and finishes. Stocked by all leading pole line hardware manufacturers.

The PALNUT Co.
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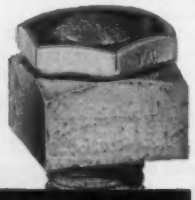


PALNUT
TRADE MARK
LOCK NUTS
for quick, secure fastening at low cost

(*Continued from page* 164)

Will Plug-ins Be Passe?

By the end of 1960 transistorized radios will eclipse completely the standard plug-in type used today predicts Henry F. Argento, vice president, Raytheon Manufacturing Co. Reasons: Costs of transistors are dropping rapidly; mass production is making more of them available; featherweight, long-life "pack" batteries, designed for transistor radios, are being developed.

Another Mother's Day Promotion

Look Magazine once again will stage its Mother's Day appliance promotion—"Make It A Great Day for Mother". Utilities and dealers participating are urged to order promotion kits ($1 each) before March 10. The campaign is scheduled to start April 17, and more than 2,000 retail outlets are expected to tie in.

New Booklets

• New version of its booklet, "Planning the Modern Home Economics Department," has been published by Electric Range Section of the National Electrical Manufacturers Association. It contains floor plans of home economics departments in some of the nation's newest schools. Get free copy from NEMA, 155 E. 44th St., New York 17, N. Y.

• Better Light Better Sight Bureau has released "Light, an Aid to Sight", an 8-page, pocket-size folder for distribution by utilities to optometrists and ophthmalogists, service clubs, schools, etc. Examples of correct home lighting are illustrated and described with information on lamp placement and bulb sizes. Prices are $2 per hundred, $1.50 per hundred in quantities of 1,000 or more. Order from Better Light Better Sight Bureau, 420 Lexington Ave, New York 17, N. Y.

Shorties

Future Farmers of America in Pennsylvania have conferred an honorary Keystone Farmer's degree on Pennsylvania Power & Light Co for outstanding services to the farm youth organization. . . . Carrier Corp has signed contract with Levitt & Sons, Inc, builders, to install central air conditioning systems in 702 homes to be built in Levittown, Pa. It is said to be largest contract ever awarded for residential air conditioning.

get your man!

ELECTRICAL WORLD's audience is everyone concerned with generation, transmission, distribution and utilization of electricity in large amounts— 25,000 *all-paid* subscribers! In utilities and big industry, among electrical manufacturers and consultants . . . only World covers the entire Electric Power Industry. Like to know more, in easy dosage? Write for "Quick Facts" . . . Electrical World, 330 West 42nd St., New York 36, N. Y.

Public Relations

. . . must be watched when emergencies arise, Liversidge tells PEA's T&D Committee

An alert awareness of the effect of public opinion on an engineer's efforts was evidenced at the recent winter meeting of Pennsylvania Electric Association's Transmission and Distribution Committee.

In a luncheon address at the Philadelphia meeting, Robert P. Liversidge, vice president of Philadelphia Electric Co, urged the group to focus attention on public relations during emergencies. Recalling the experiences of his company during the 1954 and 1955 hurricanes, he pointed out that an effective program for handling the public in such emergencies can win full-time customer good will and cooperation.

Tree Planning Important

Another area in which a utility's effectiveness is highly dependent on public cooperation is in the use of small trees along public highways. This was pointed out by John W. Anderson, general superintendent, Philadelphia Division, T&D department, Philadelphia Electric.

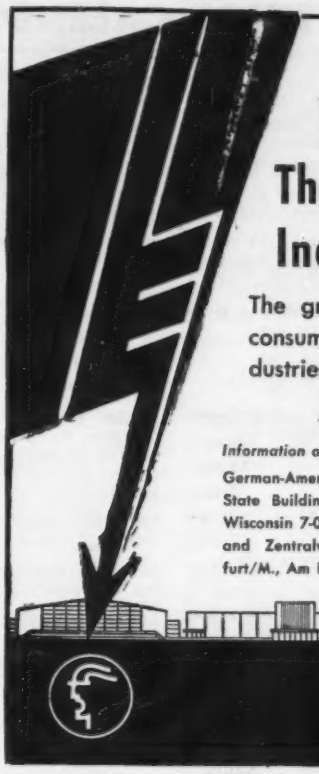
Anderson explained the organization and operations of the Pennsylvania Nurserymen's Association. He emphasized that a utility can sell the small-tree idea to nurserymen and thereby smooth the way for public acceptance and cooperation.

The nurseryman can make a profit and aid the utility's program, Anderson declared, by stocking small trees and planning a long-range program aimed at public acceptance of the concept.

EEI's Tree Book Available

The group was urged by Anderson to use Edison Electric Institute's recent publication, "Our Streets Can Be Beautiful and Useful," as an aid in winning public acceptance of the small-tree concept.

The 141-page book records the proceedings of the first street tree and utility conference (March 1955). It sells for $2.40 but can be obtained from EEI at $1.20 per copy in orders of 100 to 499.



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APRIL 29–MAY 8, 1956

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German-American Trade Promotion Office, Suite 6900, Empire State Building, 350 Fifth Avenue, New York 1, N. Y., Tel.: Wisconsin 7-0727, Telex: Ny 209.
and Zentralverband der Elektrotechnischen Industrie, Frankfurt/M., Am Hauptbahnhof 12 (Germany).

APRIL 29 to MAY 8 1956

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MEETINGS CALENDAR

FEBRUARY

PENNSYLVANIA ELECTRIC ASSOCIATION—System Planning Committee (Winter Meeting), Hotel Roosevelt, Pittsburgh, Pa., Feb. 20-21; Prime Movers Committee Meeting, Ben Franklin Hotel, Philadelphia, Pa., Feb. 23-24.

NATIONAL ADEQUATE WIRING BUREAU—12th Annual Conference, LaSalle Hotel, Chicago, Ill., Feb. 23-24.

AMERICAN MANAGEMENT ASSOCIATION—2nd Annual Electronics Conference & Exhibit, Hotel Commodore, New York, Feb. 27-29.

AMERICAN SOCIETY FOR TESTING MATERIALS—Committee Week, Hotel Statler, Buffalo, N. Y., Feb. 27-March 2.

MARCH

SOUTHERN SAFETY CONFERENCE, INC—Southern Safety Conference & Exposition, Hotel Biltmore, Atlanta, Ga., March 4-6.

SOUTHEASTERN ELECTRIC EXCHANGE—23rd Annual Conference, Boca Raton, Fla., March 12-14.

NATIONAL ASSOCIATION OF CORROSION ENGINEERS—12th Annual Conference, Hotel Statler, New York, March 12-16.

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION—Edgewater Beach Hotel, Chicago, Ill., March 12-16.

* **AMERICAN INSTITUTE OF INDUSTRIAL ENGINEERS**—Fifth Annual Spring Conference, Hotel Cleveland, Cleveland, Ohio, March 15-16.

EDISON ELECTRIC INSTITUTE—Industrial Relations Committee, Muehlebach Hotel, Kansas City, Mo., March 15-16; Street Lighting Committee, Minneapolis, Minn., March 23-24; 22nd Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., March 26-29.

* **INSTITUTE OF RADIO ENGINEERS**—Annual National Convention, Waldorf-Astoria Hotel, New York, March 19-22.

TENNESSEE VALLEY PUBLIC POWER ASSOCIATION—10th Annual Meeting, Farragut Hotel, Knoxville, Tenn., March 30-31.

APRIL

* **AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS**—South West District Meeting, Baker Hotel, Dallas, Tex., April 2-4; Great Lakes District, Fort Wayne, Ind., April 16-18; Technical Conference, Bradford Hotel, Boston, Mass., April 26-27.

INDIANA ELECTRIC ASSOCIATION—16th Annual Young Men's Utility Conference, Hotel Van Orman, Fort Wayne, Ind., April 4-5.

ELECTRICAL MAINTENANCE ENGINEERS ASSOCIATION—8th National Biennial Electric Industry Show, Shrine Exposition Hall, Los Angeles, Calif., April 5-7.

MARYLAND UTILITIES ASSOCIATION—Annual Business Conference, Lord Baltimore Hotel, Baltimore, Md., April 6.

MIDWEST RESEARCH INSTITUTE—Symposium for Management on Applications of Analog Computers, Hotel Phillips, Kansas City, Mo., April 10-11.

POINT OF PURCHASE ADVERTISING INSTITUTE—10th Annual Symposium & Exhibit, Hotel Sheraton Astor, N. Y., April 10-12.

* **NORTHWEST PUBLIC POWER ASSOCIATION, INC**—Annual Membership Meeting, Ridpath Hotel, Spokane, Washington, April 11-13.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Engineering & Operation Section, Hotel Vancouver, Vancouver, B. C., April 11-13.

SOUTHEASTERN ELECTRIC EXCHANGE—Engineering & Operation Section, Bon Air Hotel, Augusta, Ga., April 12-13.

EDISON ELECTRIC INSTITUTE—National Conference of Electric & Gas Utility Accountants, sponsored jointly with AGA, Hotel Commodore, New York, April 16-18; Engineering Committees, Edgewater Beach Hotel, Chicago, Ill., April 30-May 2.

ATOMIC INDUSTRIAL FORUM, INC—Atomic Energy Conference, Atlanta, Ga., & Oak Ridge, Tenn., April 17-19.

PACIFIC COAST ELECTRICAL ASSOCIATION—Administrative Services Section Meeting, Huntington-Sheraton Hotel, Pasadena, Calif., April 18-19.

MISSOURI VALLEY ELECTRIC ASSOCIATION—Engineering Conference, Hotel President, Kansas City, Mo., April 18-20.

* **CONFERENCE FOR PROTECTIVE RELAY ENGINEERS**—Ninth Annual Conference, Department of Electrical Engineering, Agricultural and Mechanical College of Texas, College Station, Texas, April 23-25.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—2nd Conference on Recording & Controlling Instruments, Bradford Hotel, Boston, April 26-27.

MAY

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—North Eastern District Meeting, Rochester, New York, May 2-4.

EDISON ELECTRIC INSTITUTE—Accident Prevention Committee, Coronado Hotel, St. Louis, Mo., May 2-4; Purchasing & Stores Committee, Sheraton Plaza Hotel, Boston, Mass., May 7-9; Commercial Electric Cooking Conference, Sheraton Hotel, Chicago, Ill., May 8.

NATIONAL FARM ELECTRIFICATION CONFERENCE—LaSalle Hotel, Chicago, Ill., May 3-4.

AIR-CONDITIONING & REFRIGERATION INSTITUTE—Annual Meeting, The Homestead, Hot Springs, Va., May 7-9.

AMERICAN WELDING SOCIETY—Fourth Welding Show, Memorial Auditorium, Buffalo, N. Y., May 9-11.

* **NORTHWEST PUBLIC POWER ASSOCIATION INC**—Engineering & Operations Section, Cascadian Hotel, Wenatchee, Washington, May 10-11.

PACIFIC COAST ELECTRICAL ASSOCIATION—Annual Convention, Las Vegas, Nevada, May 14-16.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Design Engineers—Design Engineering Conference, Convention Hall, Philadelphia, Pa., May 14-17.

PENNSYLVANIA ELECTRIC ASSOCIATION—Relay and Electrical Equipment Committees, Hotel Roosevelt, Pittsburgh, Pennsylvania, May 17-18.

INDUSTRIAL HEATING EQUIPMENT ASSOCIATION, INC—Spring Meeting, The Homestead, Hot Springs, Va., May 20-23.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Business Development Section, Benjamin Franklin Hotel, Seattle, Wash., May 21-23.

CIGRE—16th Annual International Conference, Paris, France, May 30-June 9.

JUNE

EDISON ELECTRIC INSTITUTE—24th Annual Convention, Traymore Hotel, Atlantic City, June 4-7.

NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS—48th Annual Convention, Ambassador-Chelsea Hotels, Atlantic City, Week of June 10.

* **NATIONAL ASSOCIATION OF ELECTRICAL DISTRIBUTORS**—48th Annual Convention, Ambassador & Chelsea Hotels, Atlantic City, N. J., June 11-14.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS—Semi-annual meeting, Statler Hotel, Cleveland, Ohio, June 17-21.

* **WORLD POWER CONFERENCE**—Vienna, Austria, June 17-23.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION—Accounting & Business Practice Section, Multnomah Hotel, Portland, Oregon, June 21-23.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS—Summer and Pacific General Meetings, San Francisco, California, June 25-29.

* **AMERICAN SOCIETY FOR ENGINEERING EDUCATION**—Annual Meeting, Iowa State College, Ames, Iowa, June 25-19.

* Additions this week.

Sell running water to increase power loads

Every installation of a Fairbanks-Morse electric water system opens the way for the sale of *more power*.

Families with new water systems almost immediately begin buying load-building appliances including electric refrigerators, water heaters for the milkhouse and home . . . electric stock water fountains . . . washers . . . driers . . . ironers . . . milk coolers . . . pipe thawers . . . dishwashers . . . and garbage disposers.

We have a cooperative plan

Homes and farms which do not have electric water systems are *prime sales targets* for power producers and Fairbanks-Morse. Our field-tested educational program can help us both. It includes panel displays, wall charts and literature that get prospects interested in buying an electric water system and other appliances. This material is used with telling effect in window and store displays, at meetings and country fairs. For details, mail the coupon today.

FAIRBANKS-MORSE

a name worth remembering when you want the BEST

WATER SYSTEMS • GENERATING SETS • MOWERS • MAGNETOS
PUMPS • MOTORS • SCALES • DIESEL LOCOMOTIVES AND ENGINES

Fairbanks, Morse & Co., Dept. EW-220,
600 S. Michigan Ave., Chicago 5, Ill.

Gentlemen:
Please tell us how we can avail ourselves of Fairbanks-Morse's promotional material to help increase our power load.

Company name.....

Your name.....

Address.....

City.....State.....

EMPLOYMENT OPPORTUNITIES

The Advertisements in this section include all employment opportunities—executive, management, technical, selling, office, skilled, manual, etc.

Positions Vacant
Positions Wanted
Part Time Work

Civil Service Opportunities
Selling Opportunities Wanted
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The advertising rate is $19.15 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

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Discount of 10% if full payment is made in advance for 4 consecutive insertions.

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Send NEW ADS to ELECTRICAL WORLD, 330 W. 42nd St., N. Y. 36, N. Y., for March 5th issue closing February 24th

ELECTRICAL ENGINEERS

SENIOR
ASSISTANT and JUNIOR ENGINEERS
COLLEGE GRADUATES

Electrical Design—Public Utility Power Plants—Distribution and Transmission Systems.

ELECTRICAL PLANNING ENGINEERS — SENIOR & ASSISTANT — Strong background and experience in power system planning and economic studies.

ELECTRIC POWER STATION RELAY & APPLICATION ENGINEER — At least 5 years experience — preparation design and specifications of relay protection for power systems. Also for short circuit, power flow and stability studies. Knowledge of d-c and a-c network analyzer, operation and symmetrical components helpful.

ELECTRICAL ENGINEERS — SENIOR — At least 10 years heavy design experience in steam or hydro plants and transmission substations. Knowledge of operation and construction desirable.

ELECTRICAL ENGINEERS — JUNIOR — Minimum 2 years experience — for electrical design of power stations and substations. Also for general analytical work on relay, short circuit calculations and economic studies.

ELECTRICAL DISTRIBUTION ENGINEER — General experience utility distribution work and studies.

Location New York—with established service organization for large group of utilities. Reply stating age, education, experience, personal particulars and salary expected.

P-9317, Electrical World
330 W. 42 St., New York 36, N. Y.

TRANSFORMER ENGINEER

Major manufacturer of distribution transformers desires experienced Design & Development Engineer for permanent position. Merit increases, profit sharing, Group Insurance plus excellent opportunities for advancement. Write giving complete resume of education, experience, and minimum salary expected. All applications treated confidentially.

LINE MATERIAL COMPANY
A Division of McGraw Electric Co.
Transformer Plant
ZANESVILLE, OHIO

POSITIONS VACANT

Efficiency Engineer—Graduate engineer with at least two years' utility operating experience and basic knowledge of utility accounting functions. Will work directly under direction of Vice President in analysis of property operation. Must be free to travel 75% of time. Submit complete resume and starting salary desired. P-9068, Electrical World.

ELECTRO-MECHANICAL

Chief Components Eng.

Several years exp. in designing transformers, synchros, resolvers, motors, etc.

Components Engr.

May be recent college grad., with or without experience but with a strong interest in the field.

Foreman

With heavy, well-rounded exp. in the FABRICATION of small electro-mech. devices; some college desirable.

Thriving, expanding Western Div. of international manufacturer of electro-mechanical equipment now creating new openings to keep pace with heavily increasing activity.

Stable future and excellent income assured. Life & health insurance and other benefits.

MR. PERLSWEIG

NORDEN-KETAY CORP.

12833 Simms Ave., Hawthorne, Calif.
OR-8-7121. OS-5-1137.

POSITIONS VACANT

3—Junior Sales Engineers or Sales Trainees by a New Jersey Electric Utility—for commercial air conditioning and refrigeration, power sales and heat pump sales contact work. Age 25-35. Technical education or equivalent. Some experience desirable. Reply stating age, education, experience, personal particulars and minimum salary expected; also, enclose recent photograph. P-9250, Electrical World.

EMPLOYMENT SERVICES

Salaried Personnel, $5,000-$30,000. This Confidential service established 1920, is geared to needs of high grade men who seek a change of connection under conditions assuring, if employed, full protection to present position. Send name and address only for details. Personal consultation invited. Jira Thayer Jennings, P. O. Box 674, Manchester, Vermont.

SELLING OPPORTUNITY WANTED

Electrical Manufacturers agent North and South Carolina, calling on distributor, industrial and OEM accounts, warehouse, office staff, 2 salesmen on road. Desire affiliation with live accounts this area. Commission basis only. RA-8731, Electrical World.

Energy Available—Buffalo!! Energetic Industrial Sales and Engineering Organization will profitably sell your product in Western New York. RA-9307, Electrical World.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1125 W. 6th St. (17)

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The engineers and technicians you want to reach are gathered in convenient, compact groups—as this 12-page booklet points out.

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330 W. 42nd St., N. Y. 36, N. Y.

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• Odd lengths—long and short—reasonably priced

One of the Largest Stocks in the Midwest

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WATTHOUR METERS

Large Quantities

Type OB, OC, CA, 1-16, 1-20, 1-30, JA.

Utilities Write or Call Collect

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76-15 Woodside Ave. Elmhurst 72, N. Y.
Phone HAvemeyer 9-0131

PERIODICALS

A.I.E.E. transactions back-volume wanted to buy for cash. Ashley, 27 E. 21, N.Y.C. (10).

Motor Winding Data, introductory selection 275 single and three phase motors. $1.10. Motor Service, Box 7631D, Kansas City 28, Mo.

U. S. Government

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4633) will be received at Denver, Colorado, until March 22, 1956, for furnishing three 69-kv (350-kv BIL), 1,200-ampere, 1,500,000-kva, outdoor power circuit breakers, one of which shall be suitable for daily switching of a shunt capacitor bank, for Grand Forks Substation, Missouri River Basin Project, North Dakota. Delivery is desired within 330 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4631) will be received at Denver, Colorado, until March 27, 1956, for furnishing seven 115-kv (550-kv BIL), 800-ampere, 1,500,000-kva, 5-cycle opening, outdoor power circuit breakers for Glendo Switchyard, Missouri River Basin Project, Wyoming. Delivery is desired within 360 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4623) will be received at Denver, Colorado, until March 20, 1956, for furnishing one 30,000/40,000/50,000-kva, 110- to 69-kv, 3-phase, 60-cycle, class OA/FA/FA or OA/FA/FOA, outdoor autotransformer, having a 13.2-kv, 4,800/6,400/8,000-kva (external load) tertiary winding, and equipped with tank-mounted lightning arresters for Grand Forks Substation, Missouri River Basin Project, North Dakota. Delivery is desired within 300 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

DEPARTMENT OF THE INTERIOR, Bureau of Reclamation. Sealed bids (Invitation No. DS-4624) will be received at Denver, Colorado, until March 20, 1956, for furnishing one 30,000-kva, 115- to 6.9-kv, 3-phase, 60-cycle, outdoor power transformer, and equipped with tank-mounted lightning arresters for Glendo Switchyard, Missouri River Basin Project, Wyoming. Delivery is desired within 360 days. For particulars, address Bureau of Reclamation, Building 53, Denver Federal Center, Denver 2, Colorado. W. A. Dexheimer, Commissioner.

SEARCHLIGHT SECTION

(Classified Advertising)

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UNDISPLAYED —RATES— DISPLAYED

$1.50 a line, minimum 3 lines. To figure advance payment count 5 average words as a line.

BOX NUMBERS count as one line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals.)

The advertising rate is $14.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request. AN ADVERTISING INCH is measured 7/8 inch vertically on one column, 3 columns—30 inches—to a page.

EQUIPMENT WANTED or FOR SALE ADVERTISEMENTS acceptable only in Displayed Style.

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K.W.	MAKE	A.C.	D.C.
1250	Westg.	6600/4160	600
1000	G. E.	12,000	600
500	Westg.	2300	275
300	Westg.	2300/440	250
400	A. C.	2300	120/240
200	G. E.	2300	250/275
200	Westg.	2300/4000	250/275
200	Ridgeway	2300	250
170	G. E.	440	125
150	G. E.	2300	125/250
150	A. C.	2300	275
150	Westg.	2300	125/250
150	G. E.	440	275
100	G. E.	2300	250
100	Elec. Mch.	440	125
100	G. E.	440	125
90	G. E.	440	60
75	G. E.	440	125
50	Reliance	440	250

CHICAGO ELECTRIC CO.

1324 W. Cermak Rd. Chicago 8, Ill.

TRANSFORMERS

FOR SALE

3—1000 KVA Mol. 11500-2400/4160Y
3— 500 KVA W-H 33000-2300/2400
3— 500 KVA G-E 22000-2300/4000Y
3— 333 KVA W-H 38000-7200/12470Y
3— 333 KVA A-Ch 13800-240/480
3— 333 KVA G-E 7200/12470Y-2400/4160Y
3— 250 KVA G-E 2415/2300-600
6— 200 KVA G-E 13200-2400/2300
6— 200 KVA G-E 13200-230/460
1—1500 KVA W-H 34500-2400/4160Y
3-ph., with substation equip't

Many other items in stock

TRANSFORMERS WANTED

Reliable rewind and repair service on all makes of transformers

THE ELECTRIC SERVICE CO.

5316 Hetzel St.
Cincinnati 27, Ohio

40 Years' Dependable Service

FOR SALE

1—Westinghouse Oil Circuit Breaker—7500V.—600A—60 cycle, type F022A serial #16Y7812 — Impulse voltage 75 KV, 17.5 gal. oil—used

1—Westinghouse oil Circuit Breaker—5000V.—600 amp—60 cycle—type F122 — serial #918727F. — Impulse voltage 60 KV, 6 gal. oil—used

ELECTRICON, INC.

19-13 Fair Lawn Ave. Fair Lawn, N. J.

— WANTED —
METERS

Any Quantity

For Sale: Recording Ammeters and standards

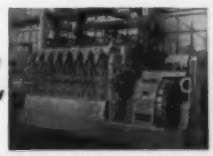
ATLANTIC
Electric Meter Corp.

214 E. 41 St., New York 17, N. Y.
OXford 7-0574

DIESEL ELECTRIC POWER

Stationary—Portable—Mobile

100 KW to 1500 KW



Engineered Diesel Power

"Union Light & Power Company" Cuba.

A. G. SCHOONMAKER COMPANY, INC.

Box 516, Sausalito, Cal. 50 Church St., New York 7, N. Y.

FOR SALE

Eight Condit Type "08" CIRCUIT BREAKERS

7500 Volt, 400 Amps., 50,000 KVA Rating on a CO-2 min-CO Duty Cycle. Manufactured 1936. In Good Operating Condition. If interested contact N. C. Stirewalt, V.P., Central Illinois Public Service Company, Springfield, Illinois.

LARGE POWER EQUIPMENT

Prompt Stock Shipment

REBUILT MOTORS - GENERATORS
TRANSFORMERS - CIRCUIT BREAKERS

DO YOU GET OUR STOCK LIST?

BELYEA COMPANY INC.

51 Howell St. Jersey City, N. J.

New and Used Equipment Available for

POWER PLANTS, SUBSTATIONS, TRANSMISSION LINES AND CONSTRUCTION

Send for new list to

EBASCO SERVICES INCORPORATED

APPARATUS EXCHANGE Two Rector St., New York 6, N. Y.

Parade Horse Named Reddy Kilowatt

Reddy Kilowatt is a registered Morrocco horse, a six-year old gelding registered in the Morrocco Spotted Horse Association of America, and owned by H. L. Wheeler, District Manager of the Chatfield District, Interstate Power Co. The trainer is Miss Lorraine Wright of Riverside Stables, Preston, Minn., who also rides Reddy Kilowatt when showing.

In 15 horse shows in 1955, the horse was never out of the ribbons, placing 2nd twice. He has featured in a newsreel in connection with Army recruiting. This year he will be used throughout the Interstate Power area in street parades and other activities promoting the company.

PLAN CEI SKYSCRAPER ON SQUARE
C.E.I. SURVEY SHOWS POPULATION TREND
4600 GET CEI PAY-PENSION HIKE
17-MILLION CEI OFFICE FOR SQUARE
CEI to Erect New Office
Nike Knocks Down CEI Expansion Plan
Ten-Year Design fo Cleveland Up to All

MONTAGE OF PRESS CLIPPINGS shows effectiveness of Cleveland Electric Illuminating Co's public relations program. CEI is celebrating 75th anniversary

Con Edison Will Show Movie at Home Parties

Consolidated Edison Co of New York has come up with a promotional and public relations idea, readily adaptable to a variety of applications in the electric utility field.

Although Con Edison is using the idea to promote gas heating, it could just as easily be used to promote some phase of electrical living, building good public relations for the utility at the same time.

Con Edison calls the idea the "Hey Charlie" picture party. The company undertakes to entertain, in any customer's home, a group of people with a movie and refreshments. All they stipulate is that a minimum of ten people be present.

The movie, in this case, is "Hey Charlie" a "delightful comedy in beautiful color with sound—an all-star Hollywood and Broadway cast," says the company. And, when the customer requests the party, "a personable young lady" from Con Edison will bring the movie and "sandwiches and cookies for the party."

Con Edison reports that 25,000 people have seen the picture, and the parties have proved successful.

What Taxes Can Mean Shown by Power Plant

The contribution to a community of a new power plant can mean much more than just a new supply of electricity. This was effectively illustrated recently by Long Island Lighting Co's Pres Erroll W. Doebler.

Announcing plans for the company's new $30 million plant at Huntington, Doebler noted that because of the large capital investment involved, the project would contribute more than $600,000 in tax money during its first year of operation.

The important thing about this, he said, "is that of this total about $375,000 will represent additional school taxes annually without creating new problems for local government. In fact, an equivalent income from residential taxes would represent a 2,000 home community of $15,000 houses with a total population of about 8,000 persons.

Ohio PUC Issues Depreciation Order

- **Commission clarifies a temporary order issued on Sept. 13**
- **Orders Cleveland Electric to use reserve account on tax savings**

The Ohio Public Utilities Commission, in an order dated Dec. 29, 1955, issued a further order clarifying the position it took in its temporary order of Sept. 13, 1955 regarding the handling of liberalized depreciation by the Cleveland Electric Illuminating Co.

The order, in the instant proceeding, said: "The matter presently before the commission is the elimination of the 'Special Reserve' account by entry either to: (a) Restricted Surplus (Capitalization), (b) Depreciation Reserve, (c) Tax Reserve.

"The applicant requests that the entry be made to (a) Restricted Surplus (Capitalization).

"Although the commission in its order of Sept. 13, 1955 stated that the accounting procedure therein set forth would not be binding upon the commission in any future rate proceeding, and although the commission will re-state the same provision in this order, **it is quite apparent that the accounting procedure could effect, at least by inference, a future rate proceeding** (Emphasis supplied).

Tax Reserve Method Best

"The proper accounting entry is one which meets the test of sound accounting and which permits equitable treatment in a future rate proceeding of the benefits resulting from accelerated depreciation. Of the three methods, the commission finds that the Tax Reserve method best meets these requirements. The commission is of the opinion that both the Restricted Surplus and the Depreciation Reserve methods more strongly infer a predilection with respect to rate regulation than does the Tax Reserve method, and therefore, the latter method provides more flexibility in a future rate proceeding for equitable treatment of the benefits resulting from accelerated depreciation.

"The contention of the applicant that a lower cost of capital would result from the Restricted Surplus method than other methods and thereby benefit both company and customers does not seem a compelling argument. The argument is based on the premise that if the capitalization is increased by the amount of the tax benefits resulting from accelerated depreciation that a larger amount of low cost bond money may thereby be obtained.

Tax Benefits Considered

"However, the larger requirements to meet the increased equity portion of the capitalization might well offset any such benefits on the debt portion of the capitalization. Furthermore, it would seem that if a larger amount of low cost bond money may be obtained by entering the tax benefits in restricted surplus rather than in a tax reserve that there must be a predisposition on the part of investors to consider the tax benefits as part of equity in so far as earnings are concerned."

As to its findings, the PUC noted: "The adoption of a method of accelerated depreciation for income tax purposes will result in reducing in the early years of the life of the property certain amounts of federal income taxes with respect to the property affected. The amount and extent of such net difference in taxes will depend upon the nature and the volume of the facilities from time to time added to the taxpayer's plant, and the election of the taxpayer as to whether certain of these facilities shall be subject to accelerated depreciation;

Restricted Surplus Plan Denied

"That if the applicant elects to adopt one of the methods of accelerated depreciation, it should be required to appropriately account for and to use the funds resulting from the reduction of taxes, **and such funds should not be available for the payment of dividends** (Emphasis supplied).

"That the request for permission to credit in the balance sheet, the tax savings or deferrals, to a restricted surplus account should be denied (Emphasis supplied).

"That the appropriate accounting treatment is to make an additional charge to operating expense annually in the amount by which federal income taxes for the year resulting from the election of accelerated depreciation in respect to any of its properties, is lesser than the federal income taxes which would have resulted had the company not elected such accelerated depreciation; and

"That the corresponding credit in the balance sheet should be made to a reserve account for future federal income taxes."

Accounting Procedure Outlined

In its order, the commission stated that ". . . the supplemental application in the above-entitled matter requesting authority to credit in the balance sheet the tax savings or deferrals to a restricted surplus account be and the same hereby is denied. It is further

"ORDERED, That if the applicant should adopt for federal income tax purposes any method of accelerated depreciation as provided for under Section 167(b) of the Internal Revenue Code of 1954, or any amendment thereto or statutory provisions in substitution therefor hereinafter enacted, said applicant shall use the following accounting procedure;

"1. To account on its books for that portion of its properties which are the subject of accelerated depreciation pursuant to its election under Section 167 of the Internal Revenue Code of 1954 in the same manner as its other properties, and to accrue depreciation therefor at rates consistent with its rates for like property not subject to accelerated depreciation.

"2. During the service life of any of its properties with respect to which it has elected accelerated depreciation

(*Continued on page* 208)

WASHINGTON COMMENT

Is Atomic Information Free Enough?

The McKinney panel said "No." But AEC claims industry can get the data it needs to go forward with a civilian atomic power program. Here is AEC case

The report of the McKinney panel on the impact of atomic energy (EW, Feb. 6, p 60) has yet to produce any sign of basic change in the information policy which governs the nation's atomic energy program.

Among its recommendations, the panel urged complete declassification of all nuclear reactor technology. Members of the joint Congressional Committee on Atomic Energy have long pressed for this, and the subject has caused frequent clashes between joint committee Chairman Clinton P. Anderson (D-N.M.) and Chairman Lewis Strauss of the Atomic Energy Commission.

Surprisingly enough, when the commissioners explained the present status of the atomic secrecy program, joint committee members showed only token disapproval. Here are highlights from the AEC testimony:

- A private citizen or company can, with the approximately 16,000 declassified technical reports now at hand, build an operating reactor, AEC Chairman Lewis Strauss told the committee. From all evidences, this would be a pressurized water reactor of the type being constructed by Westinghouse Electric Corp for Duquesne Light Co at Shippingport, Pa.
- Since no qualified individual or company would risk his or its stockholders' money on something so new without investigating all possible competitive devices, a prospective reactor builder will continually press for more and more information. This may include information on performance of reactors which have direct military application. When needed, this information is supplied to appropriately cleared individuals and organizations.
- AEC now supplies types of information under its access agreements program which are not available otherwise. For example, a person holding an access agreement can walk into an AEC laboratory or test facility and interview a scientist or engineer engaged in an experiment even before the experimenter is prepared to put his findings in a report. Ofttimes the permit holder is able to review a draft copy of an upcoming report without having to wait until the report is completed and goes its rounds through the governmental chain of command.
- AEC's declassification efforts have been speeded up. The agency decided to take this step rather than wait to see if Congress orders a change in the laws under which the agency operates. AEC scientists have selected a total of about 25,000 reports to be reviewed. From these, they chose about 500 deemed by AEC to contain information of the most interest to industry to be screened for declassification first. A second batch of about 2,000 was next in priority; these were felt to be next in importance to industry.
- AEC has completely declassified about 9,000 of the 25,000 reports reviewed, classified about 6,500 confidential, and retained about 10,000 in the secret category. "L" clearance, which takes a few weeks, is required of an individual wishing access to confidential data. "Q" clearance, a full-scale, months-long FBI background check, is required for access to secret data.
- The various AEC installations prepare local guides for their contractors. This aids contractors in determining what types of information concerning the specific projects they are working on can be passed on to subcontractors and others with whom they deal.

Ohio PUC Order

(*Continued from page* 207)

under Section 167 of the Internal Revenue Code of 1954, and in any year in which a net difference of federal taxes on income results therefrom, to charge (or credit) to provision for future federal income taxes, and to credit (or charge) to a reserve account for future federal income taxes an amount or amounts in total for each year equal to such net difference in taxes.

"It is further ORDERED, that the commission's order entered in this cause on Sept. 13, 1955, be and the same hereby is modified accordingly effective forthwith, provided, however, that nothing herein shall be construed as being an approval by this commission of the reasonableness or justness of any rate, charge, rule or regulation filed with this commission, nor binding upon this commission in any future proceedings regarding the reasonableness or justness of any rate, charge, rule or regulation."

As of this date, there have been issued 18 accounting orders by 14 State Commissions with respect to electric utilities. One rate order has been issued by the Pennsylvania commission with respect to a water company, wherein the commission allowed only actual taxes.

As to natural gas utilities, the only rate order received was by the Oklahoma Natural Gas Co dated June 29, 1955.

The significant statement in that order said: "The earnings of the company for rate determination purposes (rate base and rate making) shall be computed on the basis of normal depreciation and any tax savings effected by the application of accelerated depreciation or amortization of emergency facilities shall not be included in such rate determination computations.

"Any such savings may be treated as income on the books of account of the company or placed in reserve, or may be partly treated as income and partly placed in reserve in such amounts and proportions and at such times as may be determined by the management of the company to be good business practice."

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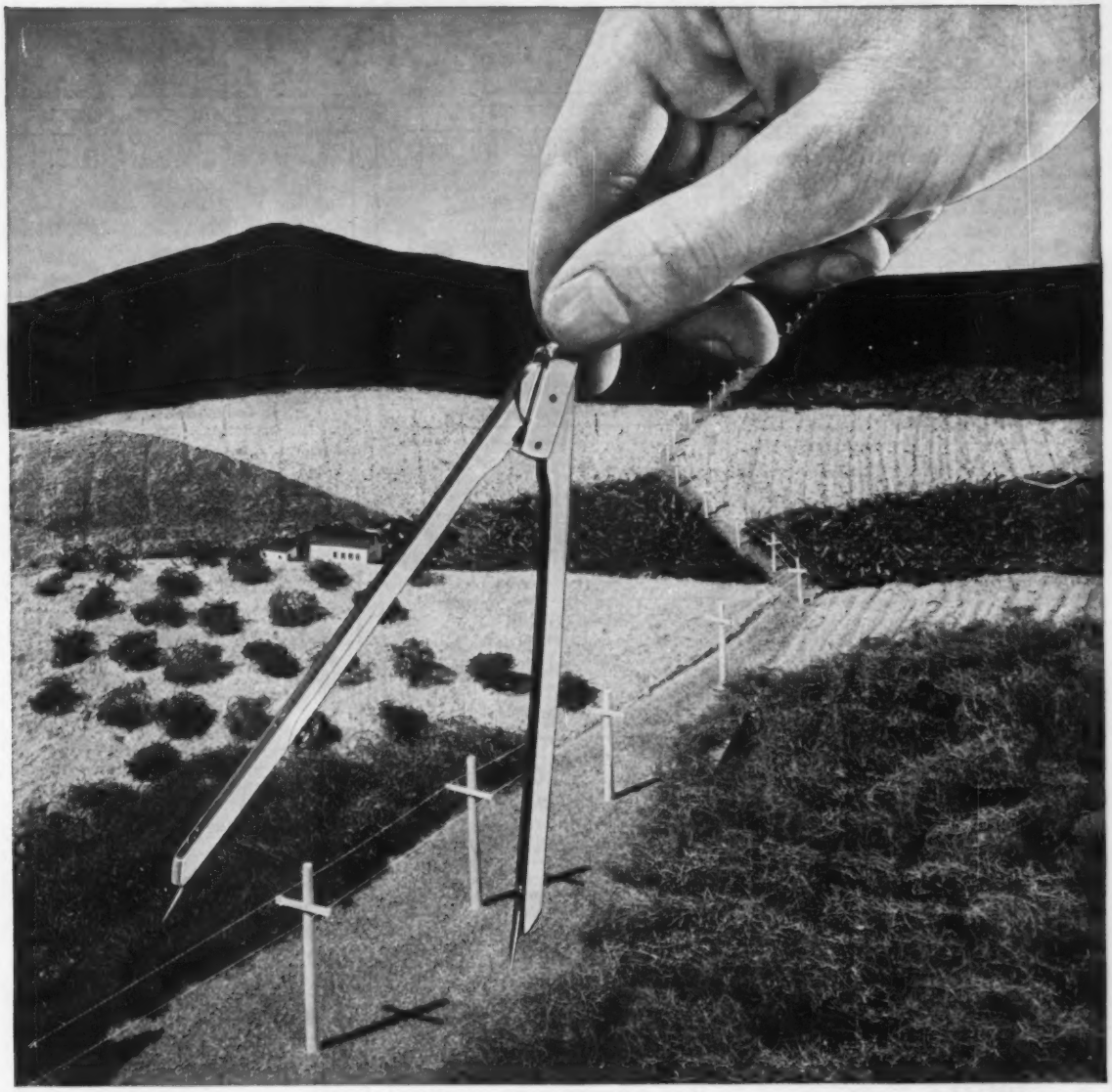

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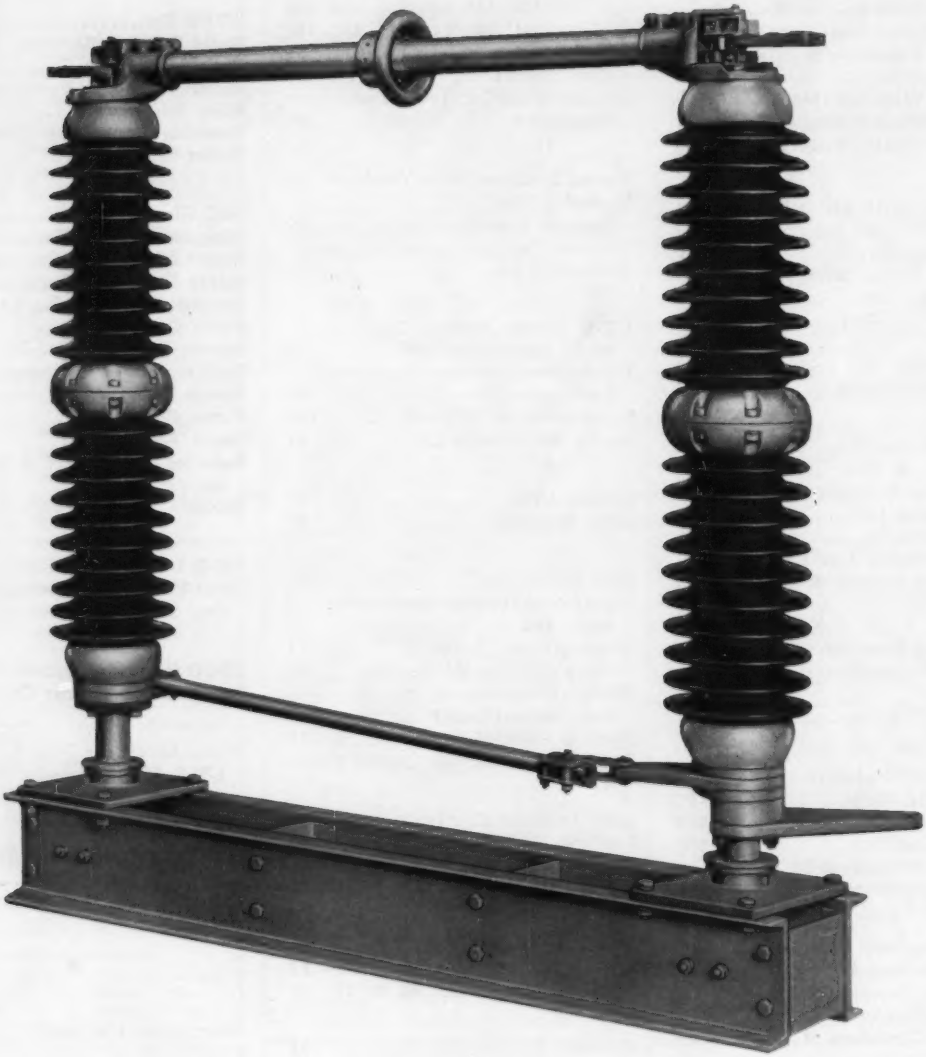

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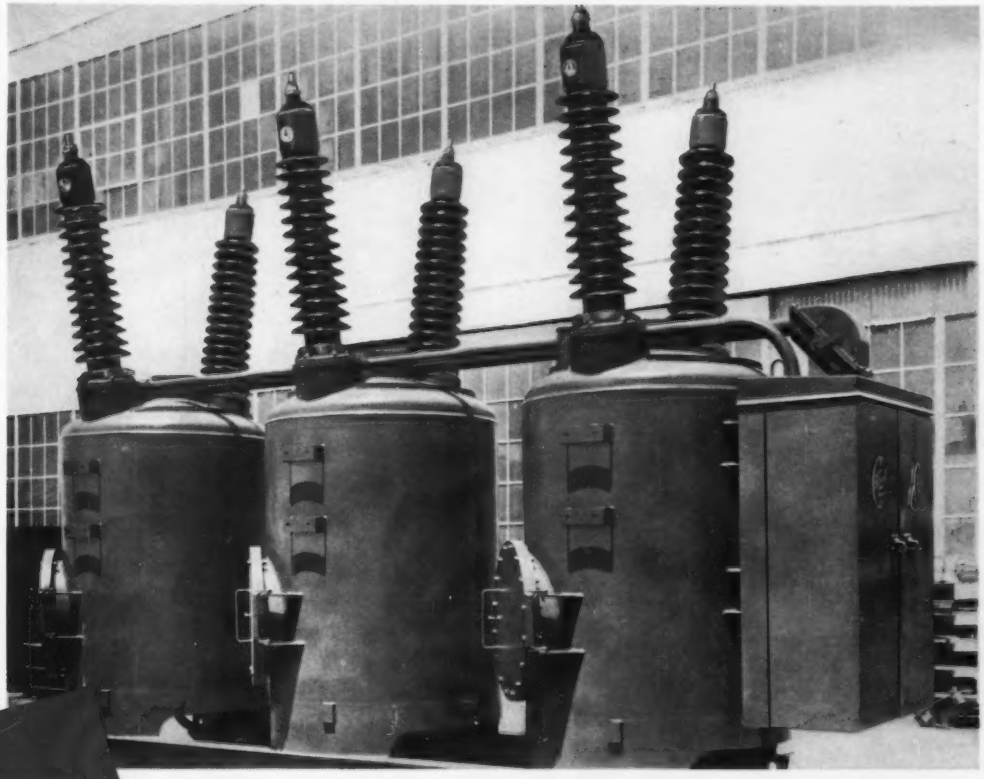

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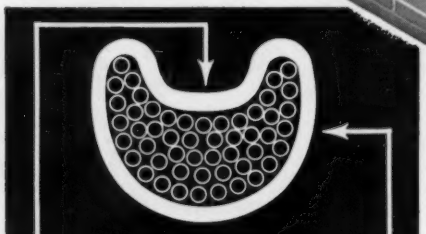

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